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EDITORIAL NOTES.

Experts' Reports on the Manchester Street Lighting Experiment.

THE street-lighting experiment at Manchester has ended in about as perfect a *fiasco* as could be imagined. When three weeks ago we made a personal inspection of the lighting, and saw the grave abuse of scientific illumination by the flame arc lamps in Portland Street, and the insufficient and inefficient character of the high-pressure gas lighting in Princess Street, we felt sure that, if the experts—Mr. Jacques Abady and Mr. Haydn Harrison—who had been called in to report upon the experiment each did his work fairly, it would be shown that the very foundation of their reports was corrupted by the characters of the display on both sides. This is amply clear from the reports, or rather from the abstract of them that has been published, at the time of writing, in one of the Manchester papers. With only the abstract before us, and a few scraps of information from our Lancashire representative, this article is being written; but our representative informs us that he has in his possession a copy of the reports of the experts, and that it shall reach us in time for publication in this week's issue [see pp. 344-348]. This explanation is due both to our readers and to ourselves, in order that it may not be taken that this article represents the result of a complete study of the full reports.

The two experts have reported separately, but they have arrived unitedly at certain general conclusions which present the whole position in a nutshell. It is evident from this—so divergent are the views of experts in the interests of clients, or what they conceive to be just to their clients—that Messrs. Abady and Harrison could not themselves settle on any common ground for making a joint investigation. We understand that photometrical measurements, expressed in candle-feet and so forth, bulk largely in the reports. The equally important question of quality of light has not much said about it; and what little is said is to be found in the report by Mr. Abady. We are not sure that any great reliance, from the *comparative* point of view, can be placed upon the photometrical or illumination tests; inasmuch as we are pretty confident that Mr. Abady—expert designer as he is of photometrical appliances—would decline to use the illumination photometer favoured and employed by Mr. Harrison; and Mr. Harrison, we venture to think, would only use his own particular child. We merely suggest this, and do not assert it to be the case without the full reports before us. What the Manchester Council will make out of all this mass of testing, with (as we suspect) different instruments, we cannot say, nor can we think they will find much value in the reports when compared one with the other. Probably the best thing they can do is to examine the two reports, reject the one which they consider shows the greater bias, and then determine whether the other one and the joint conclusions, in view of the vitiation of the whole foundation of the tests, warrant them in proceeding upon the advice tendered in the selected report.

The general conclusions to be drawn from the reports—and these general conclusions have been signed by the two experts—are three in number. The first one is that, for all practical purposes, the degree of illumination in Portland Street and Princess Street is practically equal. The second conclusion is that: Based on the actual costs of current, gas, &c., "*as given to us by the respective departments*," the arc lamps used in Portland Street [be it remembered these are 11-ampere lamps, with plain glass globes, only slightly obscured at the bottoms, giving a harsh, flickering, dazzling light], are provided at an annual cost less than the gas-lamps in Princess Street. But this conclusion bears on the third one, which says that as a comparison between the possibilities of arc lighting and high-pressure gas-lighting, the results are vitiated by the fact that the high-pressure gas-lamps are giving an efficiency very much below similar lamps when properly installed and adjusted. These conclusions are signed by both experts.

Here we have an important admission put forward, and an important illuminating fact attested, by both experts—that, though the high-pressure gas-lamps are not doing (the figures permit the use of the word) half as well as properly installed and adjusted high-pressure lamps elsewhere, they give a degree of illumination identical with what was found in Portland Street with the carefully nursed eleven-ampere electric lamps, with the plain glass globes only slightly obscured at the bottoms, which transgress the laws of scientific illumination for the sole purpose of gaining a volume of light conquest over gas, and then not successfully. If that is not a victory for gas, with even inefficient lamps, then we do not know what is. If the lamps in Princess Street were giving the efficiency realized elsewhere with properly installed and regulated lamps, then it means that not only in quality of illumination would Princess Street have been the better lighted, but the volume of illumination there would have been twice as much as is found at the testing level—with all the wrestling with the lamps, and all the defiance of the laws of illumination—in the arc-lamp-lighted street. There is something in this finding that will seriously entangle our electrical friends in their future arguments concerning high-pressure gas and flame arc lighting for street purposes. It brings us very much closer to a recognition of what we have long tried to get recognized, and that is the importance of quality of illumination (as being rightly admissible within the lines of economic consideration, as it means value for money) as distinct from the cost per candle or candle-foot per annum, which is coming down to the infinitesimal, and, in the case of arc lighting, taking over-all costs, usually works out to a considerably higher cost than gas lighting per mile of lighted thoroughfare.

There is no mistake about both experts agreeing that the trial high-pressure lamps are not doing nearly so well as they are doing elsewhere, though equalling the flame arcs in volume of light at the testing-level; but the two experts make the statement in a manner that is, to say the least, markedly distinctive. Mr. Abady's personal experience is that in the streets of London—not in the photometer-room—he gets an efficiency of over 50 candles per cubic foot of gas consumed. Then why only 27 candles in Manchester? There is proof here of local defect. Mr. Harrison too admits, but it does not strike us (perhaps we are wrong) that he does so with any particularly good spirit, that he has tested high-pressure lamps which give a better efficiency. If the lamps can give better efficiency in one place, they can be made to do so in all. But let us see to what Mr. Harrison attributes this better efficiency. He says (so we gather from the abstract of the report before us) that it is obtained by the use of a higher pressure, which necessitates, with more time and money, constant and careful periodical adjustment. Now that is where Mr. Harrison makes one of those splendid false hits that even electric lighting experts can and do make. A higher gas pressure does not mean more constant and periodical adjustment. A higher pressure enables the use of a governor at each lamp, which will keep the pressure absolutely uniform at the burner; and, under that regularity of condition, the extra frequent adjustment of the lamp that Mr. Harrison deems necessary is purely a myth. It comes to this that—if two-burner gas-lamps instead of three-burner lamps were installed in Princess Street, and they were rendering the duty per cubic foot given by the London high-pressure lamps—even then, on the experts' own showing, they would be doing better than the arc lamps in Portland Street, while giving more refined illumination. In his report, Mr. Abady says that (with all the admitted duty inefficiency of the lamps) the lighting in Princess Street, in respect of the amount of general illumination, the quality of the light, and freedom from involuntary extinctions, is better than the electric arc lighting in Portland Street.

We hope the Manchester Council will keep these points well in front (as well as the inadequate character of the tests owing

to the defective efficiency condition of the lamps), in considering and discussing the reports with the view to the future of the lighting of the main thoroughfares of Manchester. The main thoroughfares of the city ought to have in them the best quality of light, the best distributed light, the light that least annoys the eyes of pedestrians, the light that will best penetrate murky or fog-laden atmosphere, and the light that has the greatest reliability. The lighting of the main thoroughfares of Manchester is not a question that has dependence upon the "costs of gas or current as given" to the experts "by the respective departments." There is something more to be considered; and that "something more" is, as we have shown, to be picked from the experts' reports.

Quality of Gaslight.

A LIGHT that may be good from the illuminating engineer's standpoint may be very bad from that of the physicist. This is a matter that is frequently overlooked when talking of illumination. If quality of light had been more frequently considered, there would have been even less changing over from gas to electricity than there has been. Everything points to the superiority of incandescent gas lighting—the comparative spectra of the various illuminants, and the visual test by experts whose work involves the matching and sorting-out of coloured objects. This testimony to superiority is quite apart from the lower intrinsic brilliancy of the incandescent mantle per unit area of the source of light. However, last winter at a meeting of the Royal Society of Arts and at a meeting of the Illuminating Engineering Society, the question of the relative values of illuminants for the purpose of colour matching was discussed, and much was heard of the transforming of artificial light to the spectrum equivalent of daylight by correcting, by the aid of filters or screens, any excess colour of the light, as shown spectroscopically, under normal conditions. When these papers were read, it was felt by us that incandescent gas lighting was not in this matter, in comparison with electric lighting, publicly receiving sufficient prominence—that among those engaged in research work in this connection, there appeared to be an utter disregard of the claims of incandescent gaslight. We therefore invited Mr. T. Thorne Baker, F.C.S., F.R.P.S., an authority on the subject, and the reader of the paper at the Royal Society of Arts, as noticed in our issue for March 12 last, to contribute to our columns an article on the question with special application to incandescent gas lighting. This he has done this week; and he promises a further communication (which will be looked forward to with much interest) on a future occasion.

In view of the fact that there is a growing demand for a light which conforms with the requirements of an ideal hygienic light. the pronouncement of Mr. Thorne Baker that incandescent gas-light particularly lends itself to the production of artificial daylight—that is, an illumination which from a hygienic and a physical standpoint is as nearly as possible the equivalent of sunlight—will be particularly noted. As a matter of fact, he gives an opening for absolutely new research by those who are intimately connected with the production of mantles. He does not see why mantle impregnating substances should not be employed (they will have to be discovered before they can be used) which would bring the spectrum of the light to the approximately physical equivalent of daylight. If such a thing were accomplished, screening would be unnecessary to suppress any excess of colour rays of the light in relation to daylight. As it is, the filters or screens required for incandescent gas light can be easily produced by simple experiment, when one has the spectrum of the light to work upon; and these filters or screens are such that they can be used with quite a moderate sacrifice of light. Another consideration favourable to incandescent gas lighting is that whereas, with incandescent electric lamps, the spectrum composition of the light changes with variations in voltage, any pressure changes with incandescent gaslights are in this particular of less consequence. For this reason in some commercial work that Mr. Thorne Baker is carrying out for a firm, they have given preference to incandescent gaslight over electric light. We shall be glad to learn more about the points that Mr. Thorne Baker has reserved for a second article. In the meantime, he has corroborated our own views, and has produced a fresh notion regarding the possibility of modifying the impregnation of mantles sufficiently so that the light will not require correcting in order to bring it to the spectroscopic characteristics of daylight.

Mr. Doig Gibb with the Juniors.

ONE who possesses the power of giving expression to much thought in few words is Mr. W. Doig Gibb, the Chief Engineer of the South Metropolitan Gas Company. We have found this before; we find it again in the "straight talk to "young men" which he delivered to the Southern Juniors on Friday last. When anyone commences by speaking of "straight talks," as a rule one fancies that someone is in for something that will not be appreciated in the most favourable spirit, and that there is to be some sharp criticism. But Mr. Gibb is not "built that way." He has a much more effective mode of going to work. His manner of criticism is of that comparative form which causes those who listen to interrogate themselves as to whether or not they are living up to the ideals that Mr. Gibb has set up. We are glad to see his appreciation of the excellent work that is being done by the junior organizations. The evidence of this work, as he puts it, is of a "formidable" character; and he realizes not only that such organizations are of considerable value, but that they are, in fact, necessary. There are a few old-fashioned people who, when we were beating-up for organization among the juniors for technical objects, said such associations would do harm, and that they could not countenance them. These old-fashioned ones have in number become beautifully less; and the Junior Gas Associations are among the things that thrive, and among the things that the gas industry would not be without to-day, having regard to its future.

There was a little tilt at examinations on the part of Mr. Gibb. The indications of examinations are being held in growing contempt by those who make a disinterested study of this mode of attempting to gauge the degree of personal attainments. Examinations are always more or less a lottery; and one never has any positive assurance that the really best man comes out at the top, and that the worst man is left behind. Sometimes quite the contrary is the case. Coolness and apt expression, more than extensive knowledge, may often gain an examination victory for a man, where profound knowledge will fail if the power of expression and nerve are absent. We know of a man who held high and responsible position in a firm of manufacturing chemists who had never been able to pass an examination in his life. But the firm knew their man. They valued more the certificate furnished by his practical every-day work than any certificate that might have been awarded to him as the result of a formal examination, in which the man always lost his head. Thus it is that Mr. Gibb is expressing a growing view of the time when he says "for my "own part, I much prefer to look into a man's training, "and opportunity for learning, and judge him on those." A cognate matter which Mr. Gibb discussed is the question of applicants for vacant positions entering into an agreement to give (say) three months' trial before being accepted finally for a new position. We think the plan a good one. The chief argument against it is that, if a man did not suit, he would find himself cut adrift again, and the situation closed to him that he formerly occupied. Why, on the other hand, should the employer be expected to buy "a pig "in the poke"? Exercise all the care he can in making his selection, he often finds he is saddled with the wrong man for the place. Every applicant for a position who has to give three months' trial must be counted a sufficient judge of his own qualifications to justify him entering on the trial. On the other hand, if on any other ground than capacity, a man is not able to succeed, it makes it the more difficult for him to be afterwards accepted by any other concern. In these days, says Mr. Gibb, the unprepared man cannot hope to get very far. The pity of it is that there are in the gas industry (as in other industries) so many young fellows who have opportunities, and deliberately allow them to pass. Touching this point, too, those who think with us that there are many young fellows who have specialized in some branch of technical work in the gas industry—such as gas-works chemistry—who are seriously underpaid, having regard to the character of their training and the responsibility of their work, will find a warm sympathizer in Mr. Gibb.

Later in the address, there were indications as to lines of work which are open for profitable prosecution. There was just a slight glance at the purification process the South Metropolitan Gas Company are developing; the finger was pointed to the loss of ammonia that occurs in gas-works operations; and even the question of the standardization of

the parts of gas cookers and fires came in. The address wound up on a high moral and social note—urging those present to make life pleasant for themselves and those with whom they came into contact; one of the means of doing this being co-partnership. It was a good address, and much in harmony with the occasion and purpose.

Coal Prices and Prospects.

THE Coal Conciliation Board unanimously agreed last week to an immediate advance of 5 per cent. in wages to miners employed in the federated area in England and North Wales; and a new agreement was signed for a period of three years for the regulation of wages, with a fixed minimum of 50 per cent. and a maximum of 65 per cent. on the standard wages of 1888. The fixed minimum wage is 12½ per cent. higher than in the last agreement, and 20 per cent. higher than the minimum in the first agreement. The 65 per cent. maximum is 5 per cent. higher than in the expiring agreement. This is interesting; and the acquiescence in the increase shows that the coal owners—whose position, we are assured from their side, is one of grand incapacity in regulating anything financial in connection with their business, including the price of coals under contracts entered into with their best customers—know that the increase can readily be met out of the prices that are now being obtained from their customers under current contract, and the still higher ones that can be commanded for all market purchases made outside contracts.

We ought really now to have come to an end of the pile of reasons that have been advanced for raising the price of coal—reasons that have contributed to cause the public to pay for coal some 4s. 6d. per ton more than they were doing a couple of years ago, the railway companies 2s. 9d. per ton more than under their last contracts, and gas undertakings—well various amounts extra, which figures are only too well known to their administrators. In this coal business, it is always found that a small average increase in expenditure is made the vehicle for a rise in the price of coal out of all proportion to the expenditure increase; and that poor beast of burden the public is made to pay the valid extra, as well as such supplement as ingenuity and acuity, or boldness, in commercial management enable the coal owners to inflict. We are told that this addition to wages will represent about 1s. per week addition to the wages of men in the federated area. That is 52s. a year. The average amount of material raised per man employed underground according to the last returns—including coal, ironstone, fire-clay, &c.—was 321 tons; and therefore the 1s. a week increase represents under 2d. per ton. But thinks any sane man that the 2d. will not be made the instrument for supporting something larger? If it does not, it will be quite in opposition to precedent with a lineal line of great length.

It has been said that we do the coal owners injustice in crediting them with such a vast amount of business acumen, which some people have the hardihood to call cupidity. This, at any rate, the coal owners can never accuse us of having said, that they have been so insane as to—we are speaking of the coal industry generally—keep their mines running, while on every ton of coal raised they have been making a loss. There may have been some mines that two or three years ago were not making profit—the balance-sheets of such mines are very difficult to get into one's possession. But if year after year back from (say) two years since, the coal owners universally were not making profits, what on earth were they tumbling over each other for to get large contracts which (one need not place this among his *credenda*) they knew would make them materially poorer rather than richer. Philanthropy has not been turned into an ideal in coal commerce by those who govern the the stores of coal underground. Talking of governing the stores of coal, we suppose it must be put down to the combination of demand and the eight-hour day that certain large gas undertakings are detecting a restriction about deliveries and coal at command. If this is so to-day, notwithstanding the filling of requirements specially attributable to the late strike, it may be found that a veritable shortage will be experienced by large consumers before many more months have run. This may not prove true; it may be only a rumour, or, as the newspapers would call it at the moment, "a strategical move in the greater scheme"—this particular scheme being for the maintainence of a high level of prices. But there it is—the rumour is afloat; and there are certain signs about us.

Personal Work in a Presidential Address.

WE say at once, though the address was long that Mr. D. J. Winslow, of Lea Bridge, delivered on Friday from the presidential chair of the Southern Junior Association, that it is one which meets our views of what a presidential deliverance to a junior organization should be, for it includes an account of some excellent research work done by the President, which gives a freshness to both subject-matter and composition. Perhaps the description of the boosting plant at Lea Bridge might have been omitted, and have been served up as a paper on a future occasion; and then we should have had an address entirely composed of investigation by Mr. Winslow, with some new ideas. It is rather a coincidence that Mr. Winslow should have introduced for publication the results of his work on colour effects of illumination and co-efficients of reflection, in the same issue of the "JOURNAL" as that in which Mr. Thorne Baker's first article appears, as referred to in preceding editorial notes.

The work of Mr. Winslow will be of interest and value; but we think it would have been eased, and the deductions checked and assured, had he obtained and given the spectra of the gas and electric lights that he brought into comparison. We are not quite sure that it always follows that because a certain tinted glass gives particular readings that one can definitely say that this shows that certain colour rays predominate in the source of the light. In every respect Mr. Winslow may be correct in the results he puts forward, regarded relatively; but it would have been interesting and confirmatory to have had the spectra of the lights he used. As Mr. Thorne Baker, for example, points out, the spectrum of an electric light may be altered by a change in the voltage; we also know that it may occur by a change in the filaments, or in the case of arc lamps by differences in the carbons. Quite certain it is that, though slight differences in pressure do not make a great difference in the spectrum of a gas-light, there is a marked difference between the spectrum of an incandescent gas-light working at ordinary pressure and one at high pressure. There are many loopholes for error in work of this kind. Among the lessons to be extracted from Mr. Winslow's experiments is that the reflective powers of a coloured surface vary according to the colour compositions of the light in use. It is also seen that the investigations again disclose that the gas mantle much more nearly approaches daylight than the tungsten electric lamp; and there is found the same suggestion by Mr. Winslow as by Mr. Thorne Baker regarding the assistance that the mantle makers may be able to render by altering the impregnating constituents of their mantles, so as to produce a light having a close approximation to daylight, without having to have recourse to auxiliary screens or such-like for correcting purposes. It is an interesting subject; and we are extremely glad to see that investigations of this kind are being taken up by the junior workers of the industry.

Regarding the three-in-one burner described in the last part of the paper—which burner admits of conversion at will to a bijou, a "Universal," or Graetzin size nozzle and mantle—while from the maintenance and convenience standpoints it may be good, we cannot conceive that, in appearance, it would meet with the approbation of many consumers who study the fitness of things. To see a bijou mantle on a fitting and in a globe equal to a Graetzin mantle suggests a solecism in lighting equipments which would not meet with great favour to-day. We have to study appearance in these days of ornamental electric lighting.

The Chemical Clause Inquiry.

The House of Lords has agreed to the suggestion of the House of Commons that a Joint Committee shall be appointed to consider the question that has arisen between the gas industry and the chemical manufacturers, as to the restriction the non-statutorily-regulated latter desire to place upon the statutorily-regulated former, with the view of curtailing the business operations of the gas industry in its raw residual products, and so closing potential markets which help to govern prices, and with the further beneficent object of placing in the hands of the free and associated chemical manufacturers an absolute control of the market prices for the raw residuals. Our readers who are concerned for the future welfare of the gas industry, and who are not obsessed by the erroneous belief that their own particular undertaking comprises the gas industry, know precisely the position of this matter. But the agreement of the House of Lords to

the proposal for a Joint Committee advances preliminaries for the inquiry. Now will come the appointment of the Committee; and then the parties may be summoned before the Committee at any time. There are signs of investigating life among the chemical manufacturers; and the gas industry must not be ill-prepared with facts and the best men to conduct its case. Quite a number of inquiries have recently reached us from chemical manufacturers for information as to tar output and prices over a series of years. The simultaneous inquiries just at this period are significant; but just at this period we have no really important statistics available. The inquiries may not have anything to do with the Parliamentary Joint Committee—but they may have. However, it is tar over which, with one accord, intelligence is being sought by chemical manufacturers.

Responsibility for Servants' Unauthorized Acts.

That the acceptance by a kind-hearted man of an invitation to render assistance in a matter in which he is not personally interested has brought trouble upon himself and others, has been frequently exemplified; and, so far as people engaged in gas supply are concerned, it was done as recently as last week in the Court of Appeal. The case, as will be seen from the report which appears elsewhere, was one in which the Manchester Corporation were sued for damages for personal injuries caused, as alleged, by the negligence of one of their servants. The facts are given in the report, but they may be briefly recapitulated here. A prepayment meter in the house of the plaintiff was thrown out of action by a coin being jammed in it, and an inspector of the Corporation, on the request of a person in plaintiff's employ, attempted to remove the obstruction with a pocket knife. Failing to do so, he went for some tools, leaving the open knife behind. In his absence, the plaintiff's little boy began to play with the knife, and in so doing injured his eye to such an extent that it had to be removed. The plea was that, in leaving the knife where the child could get at it, the inspector had been guilty of negligence, and that as this occurred in the course of his employment, the Corporation were liable for damages. At the trial before Mr. Justice Bray and a jury at the Manchester Assizes, the defendants submitted that, in doing what he did, their servant was not acting within the scope of his authority, he being an inspector of fittings—not a repairer of meters. They also pleaded that the accident was not one which could reasonably have been expected as a consequence of the knife being left in the house. His Lordship put six questions to the Jury; and the answers given were that the inspector was guilty of negligence, that the accident was caused thereby, that as the act was done in the course of his employment the Corporation were liable, and that there was no negligence on the part of those in charge of the child. They awarded the plaintiff £125 damages; but, after hearing arguments on the findings of the Jury, his Lordship ordered judgment to be entered for the defendants, on the ground that, in his opinion, there was no evidence to support them. Plaintiff applied for a new trial or judgment, but, without calling upon Counsel for the respondents, their Lordships unanimously dismissed the application. It was well to have the decision of Mr. Justice Bray reviewed by a higher Court, because the case will probably be taken as a precedent. The Jury doubtless sympathized with the plaintiff in the domestic trouble he had sustained; and their desire to fix upon the servant of the Corporation the entire responsibility for it led them to answer in the negative the question as to whether or not there was negligence on the part of those who had charge of the child. Some people might be inclined to hold a different opinion on this point. At all events, it has been definitely settled that no legal responsibility rests upon the Corporation.

The Power of Directors.

Reference was made last week to a letter in "The Times," the writer of which stated that an eminent counsel whose speciality is company law had answered in the negative the two following questions: (1) Has a director of a company independent right of access to the books of the company for the purpose of gaining information? (2) Has a director of a company an independent right of access to the correspondence of the company for the purpose of supplying himself with information? Further correspondence in the columns of our contemporary shows that opinion is not by any means unanimous on the point. A company solicitor, who differs from the opinion given by counsel, says that, though directors can *primâ facie* only act by resolution passed at a duly convened board meeting at which a quorum is present, and no director has individual powers unless delegated to him, yet the directors of a company are the managing partners of the concern, and as such are entitled to the same rights of access to the books of the company as are the members of an ordinary partnership. How, he asks, is it suggested that the business of a commercial concern could be carried on if, on every occasion when a director wished to make himself acquainted with the facts in order to come to a decision at a board meeting, a resolution would have to be previously passed by the board authorizing him to inspect the minute-book or correspondence, or if all directors would have to be present when he desired to do so? In support of his contention, he quotes a decision of the late Mr. Justice North, that a director has a right to inspect and take notes of all documents held for the company *virtute officii*. Another solicitor draws attention to the fact that in Buckley's "Companies Acts" it is laid down that it is the duty of the directors to be acquainted with the proceedings of the board of which they are members; while in Chadwyck Healey's "Company Law and Practice" it is distinctly stated that a director has the right to inspect and take copies of all documents belonging to the company.

The Baronet and the Ladies.

The sympathy of the sterner sex associated with the gas industry will go out to those lady investors in gas companies who have been molested by the communications of the Baronet and retired Solicitor, Sir C. B. H. Soame, whose name has had conspicuous place on the prospectuses of a number of companies whose financial results have not turned out well for the beguiled investors. This individual has been making personal efforts to get rid of shares in the New Toddington and District Gaslight and Coke Company which have been hawked about throughout this year, and which have not found in us supporters in creating a market. The Baronet and retired Solicitor seems to have adopted the new avocation of share-agent—probably anticipating that a good-looking title will go a long way, more especially among the ladies. He is operating from offices at 115-117, Cannon Street, E.C.; and from there copies of letters commencing "Dear Madam" have been sent, with a print of a New Toddington prospectus, to quite a number of lady holders of shares in substantial gas concerns. The lady shareholders in one undertaking all appear to have received one of these precious communications, but not one of the men shareholders, so far as can at present be ascertained. Incensed husbands have forwarded copies of the letter to us as received by their wives with the prospectus. One of them writes: "For barefaced effrontery, this will be difficult to surpass." This seems to be the common opinion among our correspondents. The Baronet's letter starts: "Your name has been given me [by whom?] as being interested in gas and industrial investments; therefore, I beg," &c. The £5 shares are offered at £4 10s., high dividends are promised, the dividend accruing for the present six months may be deducted from the purchase money, and interest is guaranteed for three years, but who the guarantors are Soame probably only knows. The ladies are asked to forward cheques made payable to "Sir C. B. H. Soame, Bart. (*Bearer*)." Let us tell the Baronet point-blank that his promoting connections since he inflicted himself upon the gas industry have not commended themselves to us in such a way as to act as a warrant to his recommendation in his new office of share-agent.

Local Authorities Opposition Costs.

It has been suggested that we should draw special attention to a matter which is considered very objectionable by certain members of the Unopposed Bills Committee of the House of Commons, in order that, though (for the sake of peace) the privilege has been allowed to a local authority on this occasion, it may not be taken that it will be regarded by the authorities as a precedent, and be permitted in future. The point is this: The Tipperary Gas Company have met with a large amount of opposition from the local Council in their parliamentary applications for powers which will be of advantage both to the town and to the Company. Against the Provisional Order of the present session the Council appeared; but an agreement was effected. Resulting from the agreement, a clause was inserted in the Company's Order providing for the raising by the Council of the necessary money by way of loan to pay the expenses incurred in the opposition; the clause being also retrospective. The repayment of the money

so raised, it is provided, shall be spread over five years. Lord Robert Cecil, as a member of the Unopposed Bills Committee, very strongly deprecates such a provision as this appearing in a Company Order, on the ground that expenditure by the Council is a public matter, and the clause, in effect, imposes a burden on the ratepayers without the ratepayers having had an opportunity of considering the matter. Lord Robert hopes that some effective precautions will be taken to prevent this being done again; and that everybody concerned will let it be known that the Committee are not favourably impressed with the course adopted in this instance. It comes to this, that the ratepayers will have to bear the expenses in one way or another; but it is only right they should have placed fully and properly before them expenditure incurred in parliamentary warfare, and not have it hidden from them by the means provided in this case. To ensure the proper cognizance of the ratepayers is the purpose of Lord Robert Cecil; and he is right.

A Municipal Water-Works Association.

In another part of the "JOURNAL" will be found a report of the proceedings at the first annual meeting, last Saturday, of the Municipal Water-Works Association, which was formed about a year ago, by representatives of the chief public water-works undertakings of the United Kingdom, in order that they may have the advantage of concentrated thought and influence in dealing with the important questions of general interest which constantly arise in the transaction of their business. Membership of the Association is limited to representatives of undertakings serving towns with 50,000 consumers and upwards; and already the roll contains about a hundred names—the total water-consuming population being rather more than 16¼ millions. The Association was inaugurated at a meeting held at the offices of the Metropolitan Water Board; and the Chairman of the Board—Mr. E. B. Barnard, M.A., J.P.—was elected as the first President. In his address, the full text of which is given in the report, he indicates the scope of the work of the Association, which will embrace questions of administration, public health, finance, and construction in connection with water supply. Under the first three headings will come watershed apportionment, purity of supply, and charges and assessments. We learn that the Association will be protective rather than competitive. The names on the roll are evidence of the existence of a feeling that such an institution is needed at the present juncture; and if the result of the Association's labours is to place the water supply of the country upon a far more satisfactory basis than it is at present, they will have accomplished an object of vast importance to the community at large. The Association starts with a full programme. It will be interesting to follow the process of carrying it out.

PERSONAL.

From a list of 80 candidates, Mr. A. C. RAMSAY, the Burgh Treasurer and Inspector of Poor, &c., of Laurencekirk, has been selected to fill the offices of Burgh Chamberlain and Treasurer to the Gas Commissioners of Dunbar.

The Directors of the Auchterarder Gaslight Company have appointed Mr. WILLIAM MANN, of Broughty Ferry, as Manager of their works. Mr. Mann has been foreman of the Broughty Ferry Gas-Works for a number of years.

The Directors of the Lochgelly Gas Company have appointed Mr. ALEXANDER NISBET, formerly clerk and collector, to be Commercial Manager, and Mr. WILLIAM HEGGIE, formerly foreman, to be Works Manager to fill the vacancy caused by the resignation of Mr. William Ewing, who has just received a lucrative appointment at St. Louis, Brazil.

Mr. H. KING HILLER (of No. 9, Victoria Street, S.W.), who has been on an extended business tour in Canada, returned to this country by the *Victorian* last week. He reports that the gas business is booming, both as regards natural and manufactured gas; but, with regret, he noted that the stocks of stoves and other cooking and heating appliances were almost entirely of American manufacture—only one cooker and one heating stove of British manufacture being seen between Quebec and Vancouver.

Dr. HANS BUNTE entered with the current term on the twenty-fifth year of his tenure of the Chair of Chemical Technology at the Technical College at Carlsruhe, of the Chemical-Technical Institute of which college he has been Principal during the same period. At his first lecture of the session, the whole of the chemical staff, students, and many former pupils assembled to congratulate Professor Bunte on the attainment of his silver jubilee at the college; and Dr. Eitner, on behalf of the company, presented him with an album containing a record of the work which had been carried out at the Chemical-Technical Institute under his guidance.

A pleasing ceremony took place in the mess-room of the Gas Mains and Distribution Department at Leeds on Saturday, the 19th inst.; the staff having assembled to say farewell to Mr. R. HALKETT, the Assistant-Superintendent, who was leaving to take up the duties of Commercial Superintendent in the Glasgow Corporation Gas Department. In presenting him with a testimonial (which consisted of a roll-top desk) on behalf of the staff, workmen, and friends, Mr. Walter Hole, the Superintendent of the Department, warmly congratulated him on his appointment, and spoke of the cordial relationship which had always existed between them. He assured Mr. Halkett that he was voicing the unanimous feeling of the staff in a very hearty expression of goodwill and best wishes for his future happiness and prosperity. Mr. A. Edwards and Mr. W. Hudson, speaking for the laboratory and office staffs, expressed their regret at losing Mr. Halkett, and wished him the best of health and every success in his new sphere. Mr. R. N. Webb, the Manager of New Wortley works, congratulated Mr. Halkett on his success in obtaining the important position he had been selected to fill in Glasgow, and Glasgow on having secured the services of one so well fitted for it. He laid stress on the necessity for gas companies and corporations to keep the industry well to the front and forge ahead, and said it was to such men as Mr. Halkett, and others in similar positions, that they must look for help to do so. Mr. Halkett acknowledged the gift and the good wishes which had been expressed.

OBITUARY.

ALEXANDER COLVIN FRASER.

ANOTHER link with the past of the gas industry has just been broken by the death last Thursday, in his eighty-second year, of Mr. Alexander Colvin Fraser. The sad event occurred at the residence of his son at Salford; the immediate cause being heart failure. Thirty or forty years since, Mr. Fraser was a prominent figure in the gas profession; and few, if any, were better known. He was a native of Inverness, and something like half-a-century ago became connected with gas manufacture, and was engaged in various ways in the gas-works in his native town and in Worcester. He afterwards held the positions of Engineer and Manager at Stornaway, Loughborough, Colchester, Middlesbrough, Barrow-in-Furness, and Bolton; but for the last twenty years he had been in business on his own account, dealing with special fire cement, &c. At one time he was the manager of a company supplying at Barnet a so-called "patent gas," which was a kind of first cousin to "coalite." Mr. Fraser was essentially one of the old school, and the high temperatures now in general use for carbonizing were unknown to him. But even with the heats employed in his time the old iron retorts collapsed, and he patented a "ribbed" iron retort which had an extensive sale. He possessed a fund of almost inexhaustible reminiscences, and several times attempted to publish in book form an account of his experiences. This would have been extremely interesting; but though he re-wrote his book a number of times, it never appeared. Mr. Fraser was one of the founders of the British Association of Gas Managers, and he passed into the Gas Institute; but his connection with it ceased in 1890. He was a man of boundless energy and resource; and up to within a few weeks of his death he was busily engaged.

The death occurred on Monday of last week of Mr. CHARLES D. PHILLIPS, J.P., who was a Director of the Newport (Mon.) Gas Company. Among those sending wreaths were the Directors, officials, and staff of the Company, who were represented at the funeral by Mr. Thomas Canning, Mr. T. H. Hazell, and Mr. A. Leybourne.

The death occurred recently, at the age of seventy-seven, of Mr. WILLIAM THOMAS BUTLER, an old and respected resident of Dorking, and for many years on the Board of the Gas Company. He was elected a Director in 1875 in the room of his father, who in that year retired from the chairmanship through ill-health; and in April, 1898, he succeeded the late Mr. J. Young as Chairman. He retired in 1904, but remained Deputy-Chairman till the time of his death.

Main-Laying Difficulties in New York.—During the past two years, the New York Consolidated Gas Company arranged to lay about twelve miles of 30, 36, and 48 inch mains, to extend their distribution and transfer system in Northern Manhattan and the Bronx. The laying of a main of any size in either of these two boroughs has become a serious problem, owing to the multiplicity of sub-surface structures to be encountered; and the difficulties attending the work are described, with the aid of a number of illustrations, in the "American Gaslight Journal" for the 14th inst., by Mr. C. C. Simpson, jun., the Engineer of the Mains and Services Department of the Company. In all the cases alluded to, where it became necessary to depart from regular pipes and specials, the problem resolved itself into one of changing the locations of all sub-surface structures which could possibly be moved, and into the space remaining, which, unfortunately, was never circular, squeezing steel shapes, forming a gas conveyor, of the required sectional area. The article is a record of the carrying-out of some troublesome work.

MANCHESTER STREET LIGHTING.

EXPERTS' REPORTS ON THE RESULTS OF THE TESTS AND INVESTIGATIONS.

Comments on the Low Efficiency of the High-Pressure Gas-Lamps.

THE Manchester City Council in May last decided to appoint two experts to investigate and report on the relative merits of flame arc light in Portland Street and high-pressure gas lighting in Princess Street; the Gas and Electricity Departments having previously carried out the arrangements necessary for the experiments. By a further resolution Mr. Haydn T. Harrison, M.I.E.E., and Mr. Jacques Abady, M.Inst.Mech.E., were chosen to carry out the investigations; and these gentlemen have now, through the Town Clerk, supplied their respective reports to the Corporation Committees concerned. Below we give in full the points agreed upon by the two experts, as well as their independent report and conclusions based upon tests extending over two months of the two systems in the streets named. It is quite possible, if time permits, that attention will be drawn to the reports at a meeting of the City Council to-morrow (Wednesday).

POINTS AGREED UPON.

In their joint letter to the Manchester Town Clerk (dated Sept. 13), Messrs. Harrison and Abady say that it was in May last that they were instructed to jointly investigate and report upon the flame arc lighting in Portland Street and the high-pressure gas lighting in Princess Street; and they add: "We have conducted a lengthy investigation, jointly, in accordance with your instructions; but for the reasons set out in Mr. Abady's report, we submit herewith (in separate reports) detailed particulars of our individual investigations and opinions. We beg to report that we are agreed upon the following points:

1.—That for all practical purposes, the degree of illumination in Portland Street and Princess Street is approximately equal.
2.—That, based upon the figures of cost of current, &c., given us by the respective departments, the arc lamps as used in Portland Street are provided at an annual cost which is less than the gas-lamps as used in Princess Street.
3.—That, as a comparison between the possibilities of arc lighting and high-pressure gas-lighting, the results are vitiated by the fact that the high-pressure gas-lamps are giving an efficiency very much below similar lamps when properly installed and adjusted.

The writers acknowledge the courtesy and assistance that they received from the officials of both departments during their investigations.

MR. HARRISON'S COMMENTS AND CONCLUSIONS.

In his supplementary report, Mr. Harrison points out, first of all, that the figures given by the heads of the two departments relating to the cost of production were taken as correct. Besides he (Mr. Harrison) does not consider that, in his capacity as an illuminating expert, he is called upon to give an opinion relating to methods adopted in allotting various charges connected with the production or sale of gas and electricity, which he thinks is a matter for the Auditors' or Accountants' Department. He is, however, prepared to state that he has carefully examined these accounts, and had there been, in his opinion, any radical difference from the usual methods adopted, he should have noted it in his report. The report proceeds:

As called for in your reference, this report is based on results obtained in Princess Street and Portland Street; but as in the case of Portland Street the length of the street is greater, and, therefore, sixteen arc lamps are installed, four only have been taken into consideration—viz., those nearest to Princess Street. This was done in order that a similar number of lamps and length of street might be dealt with in each case.

An accurate comparison of two systems of street illumination naturally necessitates that the cost of producing and maintaining the light be carefully computed; all factors incidental to such cost being included, and that the relative value of the illumination resulting be accurately gauged.

The measurement of light and illumination has now become a science, the degree of accuracy of which is only limited by the personal error of the observers using photometric instruments. Many years' experience of street photometry have convinced me that an accuracy within 5 per cent. can be relied upon for direct candle-power measurements, and within 7 per cent. for horizontal illumination measurements, provided only that the photometer used is correctly designed and constructed for the purpose.

In this case, three photometers were used by myself and my assistant—one being a portable instrument, fitted with a Bunsen screen, the other two were the universal photometer, as manufactured by Messrs. Elliott Bros. The accuracy of this pattern of instrument is very high, as the flicker attachment is used for direct measurements—thus reducing to a minimum any error due to variation in colour of light sources; and for horizontal measurements, the arrangement adopted by Mr. A. P. Trotter, of the Board of Trade. The object in using two of these instruments was that they could be alternately sent up to my laboratory in London for periodical calibration without interfering with the tests, which were carried out every night when the weather permitted. Tests with these instruments were constantly and independently made by myself and my assistant over a period of two months, and as our results were practically identical, it follows that the accuracy of the light measurements may be taken as being within 5 per cent.

The artificial illumination of streets being carried out by means of light sources fixed at intervals along the street, results in a varying degree of illumination, depending upon the distance from the light sources, and as that illumination is proportionate not to the distance only, but to the square of the distance and the angle at which the light falls on the surface, it will readily be seen that much depends not only on the candle power of the lamps, but even more on the way they are spaced and the height at which they are erected. With the object of bringing all the factors—namely, candle power, distance, and height—into a common factor for comparison purposes, it is becoming the practice to compare the illumination of streets by ascertaining the minimum horizontal illumination, at any part of a street, of a screen 3 feet above the ground level. This minimum factor is considered the important factor, not only because it embodies all the others, but because if the minimum illumination is sufficient for the pedestrian and road traffic the illumination throughout the remainder of the street will be ample. Therefore, in this report I have laid particular emphasis on the comparison based on minimum horizontal illumination. But in order that the various factors which go to make up this result may receive consideration, they are also dealt with in detail. In order to arrive at the data necessary to prepare the report, we have conducted a series of tests extending over a period two months in duration. These tests included:

1.—Photometric measurements of candle power and illumination, which were carried out every night when the weather permitted.
2.—Periodic measurements of gas consumption and gas pressure to check those as recorded by the gas-meters and recorders installed.
3.—Periodic measurements of electricity consumed, to check the electricity meters installed.
4.—Tests of the low-pressure gas-lamps lighted in Princess Street after 11.15 p.m.
5.—Daily and nightly inspection of the lamps, to check consumption and renewal of mantles, carbons, cleaning, repairs, &c.

During the procedure of the tests, the lamps were operated in a manner usual in ordinary practice—adjustments and alterations being only permitted when found absolutely necessary But in the case of the mains connecting the high-pressure gas-lamps to the compressor-station, as a considerable leakage of gas existed, the localization of this was permitted; and the gas lost through this leakage has not been taken into consideration when calculating the gas consumed in the lamps. In the case of the electric arc lamps, the reflector, ash-tray, and support were modified in the case of one lamp to demonstrate that the shadow cast under the lamp can be eliminated.

In ascertaining the cost of the rival illuminations, the cost for gas or electricity required is based on the cost per unit or per 1000 cubic feet, as handed to me by the Engineers of the respective departments. These figures were accompanied by the particulars necessary to show the method by which these costs were arrived at. These I have carefully investigated; and I agree that they truly represent the cost of low-pressure gas as delivered at the compressor-station, or electricity as supplied to the street lighting distributors. I have not dealt with these details, the merits of which are purely psychological—such as the general appearance, colour of the light, glare, &c.—as I am of opinion that the effect of these on different people depends largely on that which they are accustomed to, and, therefore, it is impossible to lay down any general rule which would satisfy all. But I would mention that both in Princess Street and Portland Street all known regulations governing these minor details have been carefully carried out.

Having recited how his report is divided, Mr. Harrison deals with the main points under separate heads, as follows:

METHOD OF ILLUMINATION.

In the cases of both Princess Street and Portland Street, the method adopted has been the erection of central light sources suspended on span wires. In the case of Princess Street, the sources of light consist of Keith high-pressure gas-lanterns, each containing three inverted high-pressure mantles, supplied with gas from the Corporation gas supply, raised to a pressure of 55 to 60 inches (of water) by means of a compressor plant situated in Piccadilly, the pumps of which compressor plant are driven by electric motors supplied with power from the Corporation Electricity undertaking. In Portland Street, the same method is adopted; the sources of light under consideration in this report

being the four lamps adjacent to Princess Street, which are of the Metroplane Magazine Flame Arc pattern, with clear inner globes and partially obscured outer globes. These lamps are connected—eight in series—across 400 volts obtained from the ordinary distributing network supplied by the Corporation electricity undertaking. Each lamp takes an average of 583 watts. The circuits are so arranged that every alternate lamp can be switched off when it is desired to reduce the illumination. In both cases, a tower ladder is used when it is necessary to adjust, trim, and clean the lamps. This, in the case of Portland Street, does not interfere with the tramways office, as only one pair of tramway rails is used; but in Princess Street the opposite is the case. Therefore, in Princess Street, I understand, lowering gear would have been adopted; but as it often proves unsatisfactory, it is not used, with the result that, when lamps require attention during the hours of traffic, the tramway system has to be interrupted.

General Criticism of Method Adopted.

The central hanging of light sources has many advantages to recommend it where powerful light units such as these are being used. The chief of these advantages are that the units may be erected at a considerable height, where they do not come into the line of vision of pedestrians or drivers of vehicles using the street. Furthermore, the illumination on the footpaths is much more even than when the light sources are supported by poles erected at the side of the footway. Another advantage is that poles being rarely needed for supporting the span wires, the footway is freer from obstacles to traffic. The only serious disadvantage is the insensibility of the lamps. This is generally got over, in the case of electric lamps, by the use of lowering gear, which draws the lamp to one side and lowers it to the footpath for attention. In the case of electric lamps, this has proved satisfactory (*vide* method adopted by City of London); but in the case of high-pressure gas-lamps, trouble with the joints is often encountered as in Princess Street. Therefore, in cases where high-pressure gas lighting is adopted, I am of opinion that the advantages incidental to centrally suspended lamps should be waived in favour of lamps supported from brackets, attached to the wall or else mounted on columns—thus allowing of a permanent connection to the gas-main.

Degree and Quality of Illumination Compared.

As previously stated, the most important factor in street illumination is the degree to which the street is illuminated. It is now becoming common practice, especially on the Continent and in America, to use as the chief factor of comparison the minimum horizontal illumination that exists on a plane at a height of 3 ft. 3 in. above the pavement level. This does not refer to out-of-the-way corners or positions where shadows occur, but is generally taken on the sidewalks or pavements half-way between two adjacent sources of light. Unfortunately, in the case of Portland Street and Princess Street the sources of light or lamps are not erected at equal distances apart—no doubt due to the difficulty of obtaining wall fixings at the exact points necessary for such equal distances.

Table I.

The gas-lamps in Princess Street vary both in height and distance apart; being as follows:

No. 1 lamp, height	25 ft. 10 in.	Horizontal distance—	
,, 2 ,, ,,	26 ,, 1 ,,	Between 1 and 2	104 ft. 10 in.
,, 3 ,, ,,	27 ,, 3 ,,	,, 2 and 3	118 ,, 6 ,,
,, 4 ,, ,,	27 ,,	,, 3 and 4	98 ,, 6 ,,
Average height,	26 ft. 6 in.	Average distance,	107 feet.

Table II.

The arc lamps in Portland Street are all 27 ft. 6 in. high; the horizontal distances being:

Between lamps Nos. 2 and 3	132 feet
,, ,, 3 and 4	116 ,,
,, ,, 4 and 5	114 ft. 7½ in.

Mean distance, 121 feet.

The distances varying, it is obvious that the actual minimum illumination would not be a fair comparison. Therefore, the mean distance has been taken in each case—namely, for the electric lamps 121 feet apart, and the gas-lamps 107 feet apart. These distances are also taken when computing costs. Thus, in the case of the electric lamps, there would be 43·6 arc lamps to the mile of a street, and with the gas-lamps 49·34 lamps to the mile. As in both cases the illumination at the minimum position is derived from the rays emanating from the lamps between the angles of 20° and 25° from the horizontal, and in the case of maximum illumination from the rays of 45° from the horizontal, the bulk of the photometric measurements were made at these angles.

Photometric Measurements.

In order to ascertain the illumination which actually resulted in practice, I personally made photometric tests from time to time over a period of two months; and in order that a nightly record should be kept, my assistant remained in Manchester to test every night when the climatic conditions permitted, and also to notify failures, extinctions, and any other details necessary to make this report complete. The results of these measurements run into many thousands of figures, which, for the sake of condensing my report, I have reduced to the following:

(*a*) Average candle power at 20° to 25° from horizontal.
(*b*) Average candle power at 45° from horizontal.
(*c*) Average minimum horizontal illumination derived therefrom on the pavement.
(*d*) Average maximum horizontal illumination derived therefrom on the pavement.

These figures are scheduled below in Table III., and indicate clearly the relative illuminating value of the two types of lamps under consideration, as arranged and used up to 11.30 p.m. After that time, every alternate arc lamp is extinguished, and the high-pressure gas-lamps extinguished and low-pressure gas-lamps lighted. The conditions are altered to that shown in Table IV.

Table III.

	Princess Street Gas Lamps.	Portland Street Arc Lamps.
Candle power at 20° to 25°	1750 c.p.	2970 c.p.
,, ,, 45°	1670 ,,	3170 ,,
Minimum horizontal illumination	0·39 ft. candle	0·5 ft. candle.
Maximum ,, ,,	1·9 ,, candles	2·26 ,, candles.

Table IV.—*Conditions after 11.30 p.m.*

Candle power at 20° to 25°	49·5 c.p.	2970 c.p.
Minimum horizontal illumination	0·004 ft. candle	0·084 ft. candle.
Maximum ,, ,,	0·7 ,, ,,	2·26 ,, candles.

Note.—The above figures are the average of all those obtained by actual measurement; but in the case of the minimum illumination in Princess Street after 11.30 p.m., this had to be calculated from the candle power of the low-pressure gas-lamps as measured direct, owing to the illumination being too low for actual measurement.

Relative Cost of Equal Illumination Derived.

The costs, excluding capital charges on lamps and special mains, are made up as follows:—

In the case of high-pressure gas-lamps: Cost of low-pressure gas delivered to the compressor, *plus* cost of compressing; cost of mantles and renewable parts; labour charges of lighting, extinguishing, and renewing parts.

In the case of electric lamps: Cost of current delivered to the street-lighting mains; cost of carbons, globes, and renewable parts; labour charges of carbonizing, lighting, extinguishing, and renewing parts.

Gas-Lamps.

The cost of low-pressure gas delivered at the compressor station, including manufacture, distribution (to that point), rents, rates, and taxes, management, and interest on loans, is set down by your Superintendent at 1s. 0·69d. per 1000 cubic feet. To this has to be added the cost of electrical energy for compressing same, which works out at 1·75 units per 1000 cubic feet, or, when charged at 1d. per unit, at 1·75d. per 1000 cubic feet—making a total cost of 14·44d. per 1000 cubic feet of high-pressure gas delivered into the high-pressure mains. Careful consumption tests carried out on two occasions proved that, after allowing for leakage, the consumption per mantle was 26·5 cubic feet per hour, or 79·5 cubic feet per hour for each lamp in Princess Street. Thus the cost per hour for high-pressure gas amounts to 1·147d. To the above must be added the cost of mantles, globes, labour, &c., which is estimated at 0·289d. per lamp per hour. It is impossible to otherwise than estimate this figure, as during the two months the lamps were under test the burning hours were too short to arrive at a reliable figure.

	Pence per Hour.
Gas	1·147
Mantles, &c.	0·1
Labour	0·18
Sundries	0·073
	1·500

To a large extent, the labour and maintenance figures have been based on those submitted by the Superintendent of your Gas Department, which are, in the opinion of the writer, fair when the lamps are working at the existing pressure, but which would be considerably higher if the pressure were increased to improve the efficiency of the lamps.

Electric Lamps.

In this case, the cost of electrical energy, depending as it does on the load factor, varies for the half-night lamps, which burn 2000 hours per annum, and the all-night lamps, which burn 4000 hours—being 1·07d. per unit for the former and 0·655d. per unit for the latter. The average of electricity meter reading showed that each lamp consumed 583 watts. Thus for one hour the cost for electrical energy would be—

(*a*) Half night lamps, 0·583 B.T.U. × 1·07d. = 0·624d.
(*b*) All ,, ,, 0·583 0·653d. = 0·382d.

To this must be added the cost of carbons and labour. Each lamp contains 14 pairs of carbons, which during the test exceeded 5 burning hours per pair. These carbons as used at present cost 76s. per 1000 pairs. Thus one hour costs 0·18d. Each lamp takes 15 minutes to trim and clean. A trimmer and his mate are employed, earning 7d. and 6d. per hour respectively. Thus the trimming and cleaning, if cleaned every 50 hours, would be 0·06d. per hour. Together with an allowance for repairs and maintenance, this makes a total cost per hour—

	All-Night Lamps.	Half-Night Lamps.
Electrical energy	0·382d.	0·625d.
Carbons	0·180d.	0·180d.
Labour	0·060d.	0·060d.
Sundries (say)	0·078d.	0·035d.
Total	0·7d. per hour	0 90d. per hour

As lighting and extinguishing are automatically carried out by time switches, no charge has been allotted to this.

Relative Capital Cost of Plant and Apparatus.

In the case of the four high-pressure gas-lamps in Princess Street, the total cost of the lamps, lanterns, poles, suspension, and all accessories erected appears to have amounted to £194 11s. 4d., or (say) £50 per lantern. The sixteen arc lamps in Portland Street, including all accessories, are stated to have cost £564 erected, or (say) £36 per lamp. The above sets of capital cost do not include any sum for high-pressure gas-mains, or compressor plant, nor, in the case of the electric lamps, for series street lighting main. The reason why these are excluded is due to the fact that they have been included in the general charges of each undertaking. Taking it that you consider this to be the correct way of dealing with this item of the capital cost, I have not included them in either case. The capital cost per mile of street would, therefore, work out at—

Princess Street high-pressure gas .	49·34 lamps at £50 =	£2467 0 0
Portland Street arc lamps . . .	43·6 ,, ,, £36 =	£1569 12 0

Relative Constancy and Reliability of Light Sources.

During the two months during which the four electric and four gas-lamps were under inspection, the maximum variations were as follows (not including extinctions):—

Table VII.

(*a*) Of any one gas-lamp . .	From 2058	candle power	to 686	c.p.
Of all gas-lamps . . .	,, 2475	,,	,, 686	,,
(*b*) Of any one arc lamp . .	,, 4400	,,	,, 2420	,,
Of all arc lamps . . .	,, 4400	,,	,, 2420	,,

It must be borne in mind that these variations often lasted over a very short period, and are, therefore, not often noticeable; thus showing that the variation in illuminating power of the gas-lamps is more than that of the electric lamps. The total number of complete extinctions was as follows:—

Table VIII.—*Gas-Lamps under Observation.*

June 16.	No. 2 out for 20 minutes
,, 18.	,, ,, ,, 60 ,,
,, 23.	,, 3 ,, all night
July 21.	,, 4 ,, ,, ,,

making a total of four extinctions.

Table IX.—*Electric Arc Lamps under Observation.*

June 14	No. 4 lamp out for 80 minutes
July 19	,, 5 ,, ,, ,, 20 ,,

making a total of two extinctions.

In comparing the above results and failures, it must be borne in mind that half the arc lamps burn twice the number of hours of the gas-lamps. Therefore, it would appear that the electric lamps are more than twice as reliable as the gas-lamps. With reference to the difference in the degree of illumination throughout the street irrespective of the variation in the candle power of the light source, this is 4·8 in the case of Princess Street and 4·5 in the case of Portland Street. Thus it will be noted that, as regards this factor, there is little to choose between the two illuminants.

Reduction of Costs to a Common Basis of Candle Power and Illumination.

From the previous figures, it will be noted that for the cost of 1·5d. per hour, the high-pressure gas-lamps, as used in Princess Street, give an illuminating value averaging 1750-candle power (at the important angles—namely, 20° to 25° from the horizontal). The electric arc lamps in Portland Street give, under similar conditions, 2970-candle power at the cost of 0·7d. per hour. Thus the candle power, at a cost of 1·5d., would work out at—

Gas at a cost of 1·5d. per hour gives 1750-candle power.
Electricity at a cost of 1·5d. per hour gives 6364-candle power.
The electric lamps giving 2970-candle power cost 0·7d. per hour.
The gas-lamps to give 2970-candle power would cost 2·54d. per hour.

As in this comparison the distance at which the lamps are spaced comes into the calculation, it is advisable to take a unit length of street—say, one mile—and ascertain the number of lamps of either type which would be necessary to give the same illumination. As the arc lamps when spaced at an average distance of 121 feet, or 43·6 to the mile, produce a minimum illumination of 0·5 foot-candle, when giving an average of 2970 candle power at a cost of £254 per annum (2000 hours burning), by calculation it will be found that 54 gas-lamps, giving an average of 1750-candle power, will be required to produce the same illuminating result. As the gas-lamps cost 1·5d. per hour, or £12 10s. per lamp per annum (2000 hours burning), the comparison works out as follows: Cost per mile minimum illumination 0·5 foot-candle—Princess Street gas-lamps, £675 per annum; Portland Street arc lamps, £254 per annum. In these figures, the cost of current in the electric lamps is taken at the all-night rate. If charged at the half-night rate, the cost would be £314.

General Comparison after 11.30 p.m.

The above figures apply only up to 11.30 p.m. After this hour, the comparisons of cost for equal illumination are still more diverse, as in the case of Princess Street the low-pressure gas-lamps, of which there would be 80 to the mile, the cost of which cannot be taken at less than £2 per lamp per annum, give a minimum illumination of only ·004 foot-candle for a cost of £160 per annum. Whereas the alternate arc lamps in Portland Street give a minimum of ·08 foot-candle—twenty times as much at about the same cost.

General Synopsis and Conclusions.

For the purpose of ready comparison of the figures under the previous headings, I submit the following table of average results obtained in Princess Street and Portland Street.

	Princess Street. High-Pressure Gas.		Portland Street. Arc Lamps.
Candle power of lamps . . .	1750	..	2970
No. of lamps to the mile . .	49·34	..	43·6
Running costs per lamp per hour	1·5d.	..	0·7d. & *0·9d.
Capital costs per mile of street	£2537	..	£1569
Running cost per 1000 candle power hours	0·857d.	..	0·236d. & 0·3d.
Cost per annum per mile equal illumination	£675	..	£254 & £314*
Minimum illumination basis of comparison	0·39 ft. candle	..	0·5 ft. candle
Cost per mile of street per annum (up to 11.30 p.m.) at above illumination. . . .	£617	..	£254 & £314*

* After 11.30 p.m.

It is unnecessary for me to add many further remarks to the above figures, as they so clearly speak for themselves. The illumination of the two streets is to all intents and purposes the same, as a difference of 20 per cent. is not noticeable without the use of accurate photometric apparatus. On the other hand, the cost of producing such illumination is widely divergent; and it is obvious that this lighting can be carried out by your Electricity Department at a considerably lower cost than is possible by the use of gas. It must also be remembered that electricity undertaking being of more modern growth, economies in cost of production are being rapidly effected. It must be clearly understood that, as called for in the reference, I have confined my report to the conditions existing in Princess Street and Portland Street during the period of my investigations; but it is worthy of note that, had the gas-lamps been working at double the efficiency, or the cost of electrical energy been double what it is, the electric arc lamps would still have proved to be the more economical for an equal illumination. In the case of high-pressure gas-lamps, I have come across examples where a better efficiency is obtained; but the large number of high-pressure gas-lamps which I have tested throughout the country have generally shown results very similar to those existing in Princess Street. In cases where a better efficiency exists, it is obtained by the use of a higher pressure, which necessitates that more time and money is spent on careful periodic adjustments. As regards the units of light adopted and the positions in which they are placed, I am of opinion that your Engineers have shown a thorough knowledge in the latest practice in the illumination of streets of such importance as Princess Street and Portland Street; but in the case of smaller or less important streets, other types of lamps of lesser candle power differently arranged should receive your careful consideration.

MR. ABADY'S REPORT.

Mr. Abady, in a letter to the Town Clerk, dated Sept. 12, explains why it was thought better that he and Mr. Harrison should submit separate reports. A question, he says, arose between them as to the interpretation to be placed on the reference. Whereas Mr. Harrison was of opinion that it was intended that they should simply accept the costs given by the respective Departments, and express the light found to be obtained from the two systems on a comparable basis of either equal cost or equal illumination, he (Mr. Abady), on the other hand, was of the opinion that the intention of the reference was that they should criticize the costs, if necessary, criticize the installations, if necessary, and generally report upon the systems of high-pressure gas and flame arc lighting (as exemplified by the two installations), so as to guide the Corporation as to the general bearing of their findings upon extensions of either system. Mr. Abady then says he has arrived at the following conclusions:

(1) That the lighting with high-pressure gas-lamps of Princess Street, both in respect to the amount of general illumination, the quality of light, and freedom from involuntary extinctions, is better than the lighting with flame arc lamps of Portland Street.

(2) That the candle power of the arc lamps is superior to that of the high-pressure gas-lamps, and that the arc lamp figures show that they are in a state of high efficiency; while the high-pressure gas-lamp figures show that the lamps are not installed or adjusted so as to obtain normal efficiency, or anything approaching it. [I wish to emphatically impress this upon the Council.]

(3) That, based upon the figures of costs given me by the Electricity and Gas Departments, I am of the opinion that the Manchester Corporation Gas Department cannot (on these figures) supply for public lighting purposes three-burner high-pressure lamps at as low a cost as can the Electricity Department supply for public lighting purposes 11-ampere flame arc lamps.

(4) While not suggesting that the costs given me by either department are incorrect, they do not appear to me to comprise all essential factors; and I, therefore, do not consider they can be safely taken as a basis in estimating for future extensions of either system.

(5) I consider the whole comparison vitiated by the fact that the high-pressure gas-lamps at the angles tested have an efficiency

of only 27 candles per cubic foot of gas, whereas it is common knowledge, and also my invariable personal experience, that the high-pressure gas-lamps, when adjusted and supplied with gas at a suitable pressure, have an efficiency of over 50 candles per cubic foot, with a minimum of 40 candles per cubic foot.

(6) While it appears to have been necessary, owing to the nature of the lighting source, to suspend the arc lamps 27 ft. 6 in. high from the road, I strongly criticize the similar suspension, at an approximately similar height, of the gas-lamps; and I suggest that in any extensions two-burner gas-lamps adjusted to a proper efficiency, placed on poles, 20 feet from the ground and 130 feet apart, would give a light equal to, if not better than, the three-burner lamps at present in Princess Street.

(7) Subject to my criticism of the installation and adjustment of the high-pressure gas-lamps, I consider that the tests justify an extension of both systems; but it follows from paragraph 6 that if it is considered necessary to suspend lamps over the tramway route 27 feet, or thereabouts, arc lamps should be selected for this purpose.

(8) I direct attention to the fact that in the figures of cost given in the body of this report, no annual charge is added for interest and depreciation on the capital outlay for lamps or mains, but the capital expended is stated separately. Seeing, however, that arc lighting on the system employed in Portland Street requires a special main, this is a factor of cost which should not be overlooked.

(9) As the tests were made in the summer, no opportunity presented itself for a comparison of the two systems during foggy weather. Any remarks under this head would, therefore, have to be based upon observation of other installations, and this the reference does not call for.

In an addendum Mr. Abady gives the reasons upon which he has based the foregoing conclusions. Firstly, as to paragraphs 1 and 2, he says that, in order to arrive at an impartial comparison between the lighting, he carried out (with the aid of his assistant, Mr. E. G. Grimwood), a large number of photometric readings, extending from June 5 to July 19 inclusive. These readings were of a two-fold nature—

(*a*) Tests of the illumination thrown on the screen of the photometer when placed horizontally and 15 inches from the ground.

(*b*) Tests of the candle power of the lamps by direct readings at certain angles.

The photometer was placed on the ground under each lamp; at a point in the centre of the carriage-way midway between each lamp (taking them in pairs); and at a point on the kerb midway between each lamp (taking them in pairs), so that a line drawn from this point would be equidistant from each lamp. He found that the average foot-candle values were as follows:—

UNDER THE LAMPS.

Under arc lamp 2	0·87 foot-candle.
,, ,, ,, 3	0·94 ,,
,, ,, ,, 4	0·44 ,,
,, ,, ,, 5	0·26 ,,
Mean of the above	0·88 ,,
Under gas-lamp 1	1·57 foot-candles.
,, ,, ,, 2	1·60 ,,
,, ,, ,, 3	1·18 ,,
,, ,, ,, 4	1·5 ,,
Mean of the above	1·46 ,,

BETWEEN THE LAMPS.

	On Road. Foot-Candle.	On Kerb. Foot-Candle.
Between arcs 2 and 3	0·222	0·231
,, ,, 3 ,, 4	0·27	0·26
,, ,, 4 ,, 5	0·252	0·251
,, gas-lamps 1 ,, 2	0·309	0·274
,, ,, 2 ,, 3	0·238	0·222
,, ,, 3 ,, 4	0·29	0·254
Mean of the above	0·279	0·250

"Now, foot-candle horizontal illumination figures," adds Mr. Abady, "require very careful and impartial interpretation, because a reading of horizontal illumination is a factor both of the light falling upon a surface and the nature of the surface itself, and will naturally vary with the variation in either the amount of light or the nature of the surface on which the light falls. For instance, if a perfect white reflecting surface is used, a high reading will be obtained. Horizontal illumination can also be calculated theoretically; but no system has yet been devised which enables the light falling upon the ground or illuminating a vertical or other object to be measured. Thus, tests of this nature are like all figures—capable of unfair or biassed interpretations. My tests, however, are not affected by these considerations, nor by the relationship between the diffusing power of the photometer surface and the ground itself, because both the arc and gas lamps were tested in exactly the same way, and by exactly the same instrument and operators. The results are, therefore, entirely comparable, and give a very good idea of the relative illumination close to the ground in the two streets lighted by the arc and gas lamps. An examination of the figures shows that the general illumination afforded by the gas-lamps is higher than that afforded by the arcs, and, in my opinion, shows a preponderance which just about compensates for the fact that the length of street between the four arc-lamps is 363 feet, while the length of street between the four gas-lamps is 321 feet. I therefore find that the four gas-lamps are giving an equivalent illumination, on an equal length of street, to the four arc lamps. It is true the width of Portland Street is slightly greater than that of Princess Street; but this is not a factor which need be taken into consideration, because the gas-lamps would light the slightly wider street with the same standard of lighting if the buildings were set back. They afford no reflection.

Quite apart from the photometrical tests, there are two factors which must be taken into consideration in judging lights and lighting effects. One is diffusion, the other is visual brightness. It happens to be a fact, for which neither the gas nor electricity departments are responsible, that in both these qualities gas lighting by mantles has a very distinct superiority over any form of arc lighting yet devised; and it is this fact (coupled with the fact that the gas-lamps are slightly lower and placed nearer together) which accounts for the lighting of Princess Street being more even and of better quality than the lighting of Portland Street, although the candle power of the arc lamps themselves is higher than the candle power of the gas-lamps. I might explain, briefly, that it is an accepted scientific fact that the eye is more sensitive to certain parts of the spectrum than others. It is also a fact that light given by a high-power (or low-power for the matter of that) gas-mantle contains a larger percentage of this useful light than does the light given by an arc lamp. This is one of the reasons why a street lighted by high-pressure gas-lamps is so noticeably brilliant—a fact which, because it cannot be measured, cannot be expressed in £ *s. d.*

It follows, therefore, that a test of candle power is only one of several factors to be considered when comparing gas and arc lighting. The results of the direct candle-power readings are as follows:

ARC LAMPS.

	At 20° S. approximate.	At 75° S. approximate.
Arc lamps 2	3034 candles	1385 candles
,, ,, 3	3170 ,,	1438 ,,
,, ,, 4	2767 ,,	1759 ,,
,, ,, 5	2826 ,,	1331 ,,
Mean of above	2949 ,,	1478 ,,
Maximum	3170 ,,	1759 ,,
Minimum	2767 ,,	1331 ,,

GAS-LAMPS.

	20° S. approximate.	75° S. approximate.
Gas-lamps 1	2245 candles	1613 candles
,, ,, 2	2431 ,,	1557 ,,
,, ,, 3	2096 ,,	1589 ,,
,, ,, 4	1922 ,,	1473 ,,
Mean of above	2173 ,,	1558 ,,
Maximum	2431 ,,	1613 ,,
Minimum	1922 ,,	1473 ,,

From careful observations and tests made, it was found that each lamp consumes 600 watts (0·6 unit) per hour, and that each gas-lamp consumes 80 cubic feet of gas. From this it will be seen that, taking the light found at an angle of 20° (which may be taken as approximately the maximum) the arc lamps have a mean efficiency of practically 5 candles per watt, whereas the gas-lamps have a mean efficiency of only 27 candles per cubic foot. The facts are the basis of my statement in paragraph 2 of the report that the arc lamps are in a highly efficient condition, while the gas-lamps are not. . . . During the tests, there were several cases of involuntary extinction of the arc lamps, and one case of late lighting-up of a gas-lamp, while on one occasion a gas-lamp was unlighted. The reason of the former was no doubt due to the lamp mechanism or broken carbons; the reason of the latter was that a heavy rain penetrated the hood of the lamp and destroyed the mantles. No mantles were otherwise renewed during the test period of nearly two months. The figure for mantle renewals is, I consider, a fair estimate. For the purpose of extinctions, all the sixteen arc lamps were observed. It should be pointed out that after eleven o'clock, when every alternate arc lamp is alight, but all the high-power gas-lamps are extinguished, the lighting of Portland Street is naturally very much better than the lighting of Princess Street.

RESPECTIVE COSTS.

Details are next given of the respective costs of the arc lamps in Portland Street and the gas-lamps in Princess Street, based upon the observations made of the current, carbon, and gas consumption, &c., and upon the estimates given by the respective departments of the cost of current and gas. The all-night arc lamps (45 per cent. load factor) cost per lamp per annum £11 6s. 5d., or 0·68d. per hour lighted; and the half-night lamps (23 per cent. load factor) £7 18s. 2d., or 0·7d. per hour lighted. In this nothing is included for interest and depreciation on capital spent on installation or general maintenance charges, or for globes, &c. The figures for gas are as follows:

	Cost per Lamp per Annum.
80 feet by 2000 hours, 160,000 feet at 13·89d. per 1000	£9 5 2
Lighting and extinguishing, cleaning, and maintenance	1 7 2
Mantles, 15 at 1s. 1½d.	0 16 10½
	£11 9 2½

or 1·37d. per hour lighted.

Maintenance is included in the above, but nothing is included for interest and depreciation on capital spent on installation, or for globes. These gas-lamps, it is added, if burning 4000 hours a year, would cost proportionately less per hour. This cost is not, however, set out, because all the lamps are extinguished at eleven o'clock, and therefore burn for only 2000 hours.

Electricity Costs.

Dealing with electricity costs, Mr. Abady says they are taken on the basis of load factor and division of fixed and running costs, and arrived at after the deduction of certain estimated traction costs.

Now, if these latter are examined, he says, it will be seen that for a total of 10,500 K.W. connected, the fixed cost is £98,716, or £9·359 per K.W. connected. On the other hand, the total of connected kilowatts on lighting and power load is 31,475 K.W., and the fixed cost is £236,851 or only £7·525 per kilowatt connected. I do not know on what basis this differentiation is made; but it will be seen that the effect is that the lighting costs are reduced at the expense of the traction costs. Again, it will be observed that it is stated that the traction costs (which equal 1d. per unit) yield no profit—that is to say, current for traction on a 36 per cent. load factor costs 1d. per unit, while current on a 45 per cent. load factor costs only 0·682d. per unit., and current on a 23 per cent. load factor costs only 1·132d. I fail to reconcile these figures, but have thought it best to base the cost of the Portland Street lighting on the costs for current given me—feeling thus free to make these criticisms.

Another factor which I wish here to dwell upon is the charge for trimming and non-inclusion of any figure for maintenance. As to the trimming, Portland Street is next to the Dickenson Street works, and that is why these lamps require the occasional emergence from obscurity of a trimmer and his mate for a quarter-of-an hour every 45 lighting hours (nine or ten days), and nothing else. In a general extension of arc lamp lighting, I think a much higher cost will be expended; and I also think (following the precedent of the Council's resolution of April 3, 1912, in respect to the charge for gas for public lighting) the cost of the street lighting staff of the Electricity Department should be charged specifically against street lighting, and not included generally in the total costs, and thus be charged against private lighting, traction, and power costs. Apparently the cost of such staff is at present but a small item; but I raise the question as a matter of principle, and as one which I do not believe the Engineer of the department would wish to be overlooked. The same remark applies to arc lighting mains where these are not utilizable for any other purpose. High-pressure mains, if run specially for street lighting, must naturally be treated in the same way; but my experience is that, generally speaking, where there is high-pressure public lighting, this is run off a system of mains which is used for other purposes, and the cost of which is therefore included in the general mains account. With respect to my above remarks as to maintenance of arc lamps, I wish to point out that the maintenance of a high-pressure gas-lamp is a different proposition to the maintenance of arc lamps, as the former depends for its efficiency essentially upon proper maintenance, provided that the lamps are in the first place properly installed and adjusted, as the four lamps in Princess Street certainly are not. I would also point out that it must not be assumed that the same lighting efficiency, of 5 candles per watt, can be obtained from any 11 ampere arc lamps as furnished by the makers. My experience is that from 3 to 3½ candles per watt is the maximum duty to be obtained, and Mr. Pearce's report of March 23, 1912, confirms this. It should further be noted that if smaller lighting units are required (7 or 8 amp. lamps), the efficiencies are still lower. On the other hand, I think the carbon costs are higher than they should be, and that it is possible to reduce the costs by the purchase of carbons of the same quality as those now used at a lower figure than £3 16s. per 1000 pairs. I believe that Mr. Pearce has a quotation of £3 2s. per thousand.

Gas Costs.

These costs are presented as complying with the Council's resolution of April 3, 1912, that the price should cover the entire cost of manufacture, distribution and management, and all other charges appertaining thereto, including capital and renewals charges. I am satisfied that the costs taken comply with this resolution. The cost for gas compression, taken at 1·2d. per 1000 feet, as a result of observations of meters is very high, owing to the fact that the compressor is not worked at anything like its full capacity or load, which is 10,000 cubic feet of gas per hour. If it were, then the cost would be materially reduced, because the amount of current required to compress 10,000 cubic feet of gas is only 4 units, or 0·4d. per 1000 cubic feet. I think I ought to point out that, in comparing the costs of electricity and gas, one ought not to leave out of consideration the fact that while the former department is without reserve and has a renewals suspense account considerably below the proper standard (*vide* Electricity Committee's report of June 26, 1912), the Gas Department is in an exceptionally strong financial position. Further than this, to make a fair comparison the amounts paid by the respective departments in relief of the rates (affecting as they do the debt and therefore the interest and sinking fund charges) ought to be brought into account. The total paid by the Electricity Department during the last ten years is £73,500, as against £605,783 paid by the Gas Department during the same period. I make these observations because I consider these points should be borne in mind; otherwise unjustifiable expectations and deductions might be drawn from the figures set down as the cost of the arc and high-pressure installations in operation in Portland Street and Princess Street.

Gas-Lamps Low Efficiency.

Referring to paragraphs 5 and 6 in his report, Mr. Abady says he is aware that the statement about the abnormally low efficiency of the gas-lamps is a strong one; but adds that it is based upon a long personal experience in testing this type of lamp, both in the laboratory and in the streets.

I have not had an opportunity, he continues, of examining the lamps in Princess Street; but from charts taken I am aware of the pressure of gas with which they are supplied. This pressure is observed from a recorder on the wall, fixed before the flexible connections to the lamps; and I suspect that the nature of the flexible connections is unsuitable, and is occasioning a loss of gas or pressure, or the presence of condensation, which no doubt accounts for the poor result obtained. I believe this to be the fault, or that the pressure and size of burner nipples and air regulation are not adjusted so as to take advantage of the benefits of high-pressure—these points being the essence of the life efficiency per cubic foot of gas which I have always hitherto obtained. An efficiency of 27 candles per cubic foot makes an absurdity. Makers of high-pressure lamps claim nominal efficiency of 60 candles per cubic foot, and with proper adjustment one can safely count upon 40 candles per cubic foot as an irreducible minimum, well within the average life of a mantle, and a maximum of from 50 to 55 candles per cubic foot.

THE NATURE OF LIGHT.

At the Polytechnic, Regent Street, last Friday, the first of the lectures on illuminating engineering was delivered by Mr. W. C. Clinton, of University College. It will be recalled that a somewhat similar series of lectures was organized last year, and it is hoped that they will become a regular feature.

Mr. Clinton's lecture served as an introduction to those to follow, and consisted mainly in a popular explanation of the nature of light, and the fundamental laws used in illumination. He illustrated, by a series of photographs of ripples in ponds, and showed by several ingenious models, how light vibrations are propagated and reflected, and how the rays are bent in refraction by optical media denser than air. These principles form the groundwork on which the design of globes, shades, and reflectors is based.

The lecturer then went on to point out that light-waves differed in quality as well as in intensity. He presented in tabular form the vast range of vibrations, from the "wireless" electro-magnetic waves of comparatively low frequency up to the very rapid ultra-violet rays. All these vibrations are of the same kind; they only differ in speed and wave length. The eye, however, can only see a certain limited region—about one octave of vibrations.

Mr. Clinton proceeded to show how the prism can separate-out the colours even in this narrow range of vibration. An enlarged spectrum of the carbon arc was first thrown on the screen. Iron filings were then introduced into the arc, with the result that the violet in the spectrum was much intensified. As an illustration of the effect of luminous gases, the spectra of mercury and neon were produced; the colour of the collective light in the two cases being respectively light green to red. This again, it was explained, would be found to bear on practical problems in illumination. An experiment was also shown, illustrating how the ultra-violet light from the electric spark can be made visible by its effect in causing vivid fluorescence of certain minerals. Ordinary clear glass absorbs a great part of these ultra-violet rays and, when interposed in front in the path of the light from the spark, very greatly diminished the fluorescence. A piece of quartz, however, though almost opaque to visible light, had here relatively little effect.

In conclusion, the lecturer emphasized the fact that the colour of an object depends both on the qualities of this object, and on the nature of the light illuminating it. The distortion of the colours of red, green, yellow, and blue cloth, as well as of various coloured liquids, when illuminated by the mercury and neon lights respectively, was shown to the audience; and very surprising differences were observed with some crystals of salts of iron and manganese.

In the next two lectures, Mr. Clinton will deal with electric lighting, and then gas lighting will be treated by Mr. J. G. Clark, of the Gaslight and Coke Company's staff.

Mr. Henry O'Connor on "Petrol Air Gas."—Early in 1909 we noticed a little book which Mr. Henry O'Connor had written on the subject of "Petrol Air Gas." Since its publication, a considerable number of new plants have been devised and put on the market, while some of the older ones have either been altered as greater experience with them has been gained, or are no longer on sale. In view of these changes, Mr. O'Connor has prepared a second edition of his book, in which he has revised and amplified the matter, which now occupies 26 pages more than in the earlier work. The text is followed, as before, by some useful memoranda and an index. The book is published by Messrs. Crosby Lockwood and Son, at the price of 1s. 6d. net.

ELECTRICITY SUPPLY MEMORANDA.

The Choice of Berlin—Light Distribution and a Fundamental Law—Costs and Costs—The "Square Deal"—Insuring against Loss of Profit through Supply Interruption—Demunicipalization and Municipalization.

It is strange how far afield, and how deeply into history, our electrical friends generally have to go for arguments against gas for lighting and other purposes of utility for which the properties with which it has been endowed by Nature show that it was intended to be used. There are electrical people who accuse Nature of having blundered; but Nature, on the other hand, has, no doubt, her views regarding the capacity of those critics to bestow a dispassionate and unprejudiced judgment on her schemes. However, let that pass. We say that our friends disclose a remarkable proneness for getting far afield for their evidence to show that economy and efficiency are on their side, and not on the side of gas. A "communicated" article appears in the "Electrical Review" on the subject of "High-Pressure Gas *v.* Flame Arcs for Street Lighting." The data given in the article are said to have been collected from practical tests, and are presented by Heyck in a recent contribution to the "Kommunalen Rundschau." Well these data of the worthy Heyck are said to be specially valuable. We suppose this is intended to mean to British readers for application to British conditions. Naturally, they show an "undoubted advantage" in favour of flame arcs, or we might not have had the article in the "Review." Before examining the figures that make the disclosure as to advantage, there are just a few remarks to be made about other of the opening lines of the article. It is our impression that it was the "Electrical Review" that once before was misled by a correspondent over the question of the relation of gas-works ownership to the great preference for high-pressure gas lighting in the city of Berlin. It is said in this particular article that "the oft-cited experience of the city of Berlin is not valid in determining whether high-pressure gas-lamps or flame arcs are economically the better for street lighting." Then we come to the assigned reason for this: "The city has its own gas-works, but no municipal electricity works. Hence there is a great municipal bias in favour of gas lighting." It is true that the Municipality supply gas from gas-works of their own to a part of Berlin; but has the "Electrical Review" never heard of that mighty corporation, the Imperial Continental Gas Association, who supply with gas a huge area in Berlin not furnished with the commodity by the Municipality. If the "Review" has not done so, then on application to the London offices of the Association in Austin Friars, information may be gathered concerning the matter. Our contemporary also does the Municipality an injustice in putting down their leaning towards high-pressure gas lighting to the fact that they do not possess electricity works. The Electricity Company who run the business in Berlin do so under a concession; and as the Municipality enjoy, as a consequence, a goodly revenue (having a certain proportion of the profits allocated to them), the foundation for the initial allegation in the article becomes very shaky.

This being so, something more is required than the Heyck data in the "Kommunalen Rundschau" to account for the preference of the city of Berlin for high-pressure gas lighting, and to which preference is due the great mileage of streets so lighted as compared with the small mileage of streets electrically lighted. Berlin goes in for quality of illumination. It does not suffer any consideration to deprive it of the best quality of light under all possible circumstances. But let us see what the person responsible for this communicated article says. In the first place, he states that the high-pressure lamps must either be hung so low that they can be reached by a ladder, or else flexible or jointed piping must be arranged so that the lamps can be lowered for trimming and cleaning. "The first alternative," it is remarked, "results in very uneven illumination." Now the "Electrical Review" knows full well, from experience in the West-end of London, that high-pressure gas-lamps are there placed on standards, and that they give a more even distribution than any flame arc lamps placed at similar height. With flame-arc lamps, it is said "there is no restriction to the height of suspension." Is not the "Review" aware that, the intensity of light received from any source of light varying inversely as the square of the distance from the source, there is a restriction to the height of suspension? The greater the height, the greater the area over which light is thrown; but the intensity of the light at any given horizontal level is lessened as the height of the source is increased. Surely, too, the "Review" is aware, talking of polar distribution, that it is a pure fabrication to say that "the pressure gas-lamp has the most concentrated and least light distribution." When statements on technical matters of this kind are made, that are demonstrably inaccurate, it is a pity that any technical paper should give them further circulation.

We come to the so-called costs of high-pressure gas-lamps and flame arc lamps as given in the article. In this matter, Germany is not England. It is stated that, including pipes and erection on a span wire or 8-metre mast, with the necessary piping or joints, the capital cost per gas-lamp averages £55 to £60; while the cost per flame arc lamp, including the erection of a span wire or mast at 9 metres above street level, is £36. High-pressure gas-lamps of 2000-candle power are being dealt with, and flame arc lamps of 1700-candle power, or 300-candle power less. Now Mr. J. W. Bradley's reports show that the capital cost of the high-pressure gas-lamps in Westminster from which he gets upwards of 4000 candles (as officially tested) amounted to £20, while the capital cost of those from which upwards of 2000 candles are obtained was £18. For the flame arc lamps a capital cost of £40 apiece was incurred. Is not our contemporary aware that the initial cost of a high-pressure lamp in this country is less than that of a flame arc lamp? Does it not occur to it that a standard 8 metres high should cost slightly less than one 9 metres high? Does it not cross its mind that the wires and gear required for the central suspension, and the raising and lowering, of high-pressure gas-lamps and flame arc lamps would be about the same? Does it not occur to it then that the difference between the cost of a length of flexible tubing for the high-pressure lamp and the copper wiring for the flame arc lamp will not amount to the extra £19 to £24 found against high-pressure lamps under the heading of capital cost in this article? In this country, too, maintenance costs per lamp do not run out to anything like £4 10s. per gas-lamp per annum. As to the cost of gas into the holder, "Field's Analysis" shows that coal (less residuals), salaries and wages and purifying expenses, in the case of the Metropolitan Gas Companies in 1911 came to 5·3d. If we add the average of 4·38d. for wear and tear, the total comes to 9·68d. So that, if competition compelled, gas undertakings could afford a fairly low price for this business rather than lose it. We see in the article that electricity for the flame arcs is reckoned at 1½d. per unit, which is not the lighting price in Berlin. We also observe that a 2000-candle power high-pressure gas-lamp is credited with a consumption of 35 cubic feet; but as this represents 57 candles per cubic foot consumed, we will not complain. But is it necessary to go farther to show the "Electrical Review" that the Heyck data as published in the "Kommunalen Rundschau," and other of the statements made in the article, must not be taken as applying to this country? Anyway, we think our contemporary, without any great strain, will be able to see that this is so.

Mr. A. H. Seabrook is delivering at the East London College a course of lectures on the "Management of Electricity Supply Undertakings." In his first lecture, he had something to say on the subject of the "square deal." We do not know exactly what points Mr. Seabrook made in this connection; but no doubt he could, did he so choose, say much more than he poured into the ears of his audience, which we regret to read was a small one. A big audience could be picked from the electrical industry to whom a discourse on the "square deal" by an authority such as Mr. Seabrook would do, or should do, an immense amount of good. There are some people who talk of "poisonous fumes" escaping from modern gas-fires, of poisonous fumes forming the products of combustion of gas in gas-ovens, of joints being able to perform simultaneously the double feat of perspiring and of absorbing those mysterious poisonous fumes. We agree there is much electrical matter that could be used in a discourse on the "square deal." The "Electrician" is in harmony with the Seabrookian doctrines relating to the "square deal." It says: "If the dishonest man can be caught, he should be punished with the full rigour of the law, as it is this type of man that endangers the privileges of the whole community. We are glad that Mr. Seabrook is preaching this broad-minded policy; and we hope that it will take good root in the minds of his students." We also devoutly hope so.

As was recently pointed out in the "Memoranda," the fires at electricity generating-stations, and the collapses of supply, have caused a good deal of restlessness among municipal owners of generating-stations. We saw the other day that a special inquiry had been made into the matter by one Metropolitan municipal authority to see if their station was passably safe. But the Bermondsey Borough Council Electricity Committee have gone one better than all the others. They have given instructions for an insurance policy to be taken out against loss of profit through inability to supply consumers owing to the stoppage of the service in the event of fire. The policy covers £6000 for three months' period of interruption. Users of the electric current should now ascertain whether they cannot insure themselves against inconvenience, loss, and "intellectual and moral damage" resulting from any interruption of supply—and with tradesmen this is more especially necessary.

At a time when so much attention is being bestowed on the development of electrical cooking in this country, it is (says the "Electrical Review") worth noting what our Canadian friends are doing towards the same end. Quantitatively the "what" does not appear to represent much. In Ottawa, the Company supplying both gas and electricity replaced a standard gas-stove by an electric kitchen range of the same capacity in a private house. The average consumption of gas per month was 5500 cubic feet. The first drawback found with the electric range was that it worked slower than the gas one, and the heat regulation was not so easy. As a result of a thirty days' test, 295 units of electricity were consumed, which, at 3 c. per unit and 10 per cent. discount, amounted to $7·97; while the cost of gas, at $1·25—say, 5s. 2d. per 1000 cubic feet—totalled (with the same discount) to $6·19. If the gas had been at the price at which a large part of the gas is sold in this country—from 2s. to 2s. 6d.—the $6·19 would have shrunk considerably.

Acton sold its electrical undertaking to a Company; Dudley is proposing to do so; Barking is prepared to consider an offer to do so; and Cromer is negotiating for the sale of its concern. The Hove Council would like to buy the local electricity undertaking; but there are ratepayers who want to know something more about the matter. Who can blame them?

ELECTRICITY FOR EVERYBODY.*

A BLUE dress and gold ornaments may cover a multitude of sins. When the new issue of the handbook "Electricity for Everybody," in its blue gown and gilt-edged leaves, was picked up for investigation for the purpose of a review, it was hoped that this was an expurgated edition of the book that, on its original appearance, was reviewed by us and found wanting in its references to gas. But there is disappointment. Although this is called the "second and revised edition," the revision has not been carried far enough. The blue, gilded dress still covers a multitude of sins; and we invite, at the outset of what we have to say, Mr. R. Borlase Matthews, Wh.Ex., Assoc.M.Inst.C.E., M.Inst.E.E., to prove in our columns that we are wrong, but not to attempt to do so by the employment of mere generalities. We have gone carefully through the book, and can say that there is a large amount of useful information in it, and there is much that is not useful, because, under present-day conditions, it is either not true, or in the terms in which it is stated it is misleading, and so ought not to have place in a book designed (so to speak) for use as a reference book with a view to the further circulation of the statements. The notes that have been made in perusing the work are voluminous; but space cannot be devoted to all the matter upon which we should like to comment. Indeed, a handbook of the kind, dealing with a perfect multitude of matters, is very difficult to completely review. However, we see that "any suggestions for the improvement of future editions will be welcomed, as the author desires to make the book of more and more value to central station engineers, contractors, and others." We will therefore take a line of criticism that it is hoped will be suggestive in making future improvement. In passing, we see on the title-page that the book is "Entered at Stationers' Hall." We thought "Good-bye" had been said to that historic institution under the provisions of the new Copyright Act.

A few introductory examples of *errata* which we find have not been deleted in the revision may be mentioned. Almost at the commencement of the book, it is stated that with electric lighting "there is *no* risk of fire." "It does not tire the eyes." Has the author missed all the evidence to the contrary? There are frequent statements in the book as to "deposit" and "blackening" from gas, and to the "dirt" from gas. But no definition of what is meant by such statements is vouchsafed. Under, however, the section of the book dealing with the electric-cooker and the gas-cooker, we get the following erudite statement: "The burning of gas involves a chemical change, which results in the formation of carbon; and this is deposited on the bottom of the cooking utensils, and makes them dirty." Mr. Matthews is a Wh.Ex., Assoc.M.Inst.C.E., and a M.Inst.E.E. Will he, therefore, kindly explain to us why Bunsen invented the burner which bears his name; and then follow it up by telling us what chemical change takes place in a normal atmospheric gas-flame that results in the production of dirt or carbon. We do not deny that where a ceiling is low, and a single high-power source of light is employed, with the products of combustion ascending direct to the ceiling, that something appears above it on the ceiling. But Mr. Matthews, is this dirt or carbon from the gas? Let us have in answer a little science and not generalities. Destructive "gas fumes" are also spoken of; but we cannot trace in the book any description of these destructive fumes. Again we say, in a text-book of this kind, let us have more science and less general statement. In another place, the author says: "There is a misapprehension to the effect that electric light cannot penetrate fog as well as gas or oil light." There is no explanation as to why Mr. Matthews labours under the impression that this is a misapprehension. We should like him to deal categorically with the point. On another page, we find the statement that incandescent gas-lamps "cannot be obtained in less than 50-candle power units." Now how can Mr. Matthews be trusted as a guide in gas matters, when, after the bijou inverted gas-burner has been on the market more than a decade, and the "Visso" upright gas-burner down as low as 16-candle power has been on the market some three years or so, he makes such an error as this? Although, being in the opposite camp, it is not our business to point out places where revision is desirable in matters electrical, we think the electrical friends of Mr. Matthews might wish him to modernize the table (on p. 63), which states that the cost of a 700-candle power mercury vapour lamp is 1¾d. per hour; 700-candle power arc, 4½d.; and 700-candle power incandescent lamp, 12d.

It is found that the author speaks of the consumption by gas of oxygen from the atmosphere. We wonder whether he suffers from the same trouble that has been noticed with other electricians, of harbouring a notion that Nature has provided fuel, but has neglected making sufficient provision for its combustion. If this were true, the men at some busy electrical generating-stations really ought not to be alive, seeing the air depreciation that must be going on there, through the consumption of oxygen for the combustion of the solid fuel used under the boilers. "The electric light," we see, "is healthy because it consumes no oxygen; and it does not pollute the air." Let Mr. Matthews take two rooms—one lighted electrically, the other by gas—with a number of people in them; and let there be nothing but simple, and not mechanical, ventilation. The negative action of the electric lamps in contributing to ventilation he will find (though not in themselves polluting the atmosphere) cannot be compared with the positive action of the gas-burners, in assisting ventilation. Has Mr. Matthews ever made any chemical tests to support the theories in relation to this question as found in his book? Does he know anything about the physical aspects of this matter? If he does not, then surely it is time, when seeking to become a teacher of men in relation to them, that he should be fortified with the scientific truth. "Does gas ventilate and heat a room?" he asks. We find appended to the question, and affecting to be the answer, nothing but the loosest assertion. He says that "the standard of ventilation set down by experts in the subject of ventilation is 25 cubic feet of pure air per minute for each occupant and for each light, other than electric light." We will not grumble over any ample provision of fresh air; but does he not realize that this 25 cubic feet per person and burner represents 36,000 cubic feet for the human and lighting individual per 24 hours, while only about 400 cubic feet of air pass through the lungs of an adult person per twenty-four hours? As a matter of fact, he himself, three pages on, mentions that an adult man consumes 16·6 cubic feet of air per hour. But we proceed: "Now the consumption of the gas only produces about 700 heat units, which is insufficient to raise this quantity of incoming air up to the normal temperature of the room in ordinary cold weather." Has anyone who has scientifically explored this question ever seen anything so lame as that? The heat units mentioned represent the measure of the thermal duty obtained from a single cubic foot of gas of a good heating quality. But there is more gas than this burned, as a rule, in any ordinary room; and in "ordinary cold weather," a fire is going as well as gas-burners.

It really comes to this, Does Mr. Matthews believe in physical laws or does he not? If he does not, then we have no more to say; if he does, it would be interesting to know how he is to escape from the revision of his views on gas lighting and ventilation. "Hence with gas," says Mr. Matthews, "under proper conditions of ventilation, more heat is required from an external source, such as a hot-water system or fire, than is the case with electric light—a point that will probably be new to many." It is new to us. It means an utter lack of contributory heat on the part of the gas-burner. We ask the author of the book to reconsider this question—scientifically; and then tell us why he made the quoted declaration. We turn to the next page; and there this text-book gives a table as to (*inter alia*) the carbon dioxide produced by various illuminants. Would it be believed that, in this year 1912, any author with a desire to be up to date would cite the carbon dioxide emission of ten 5-feet flat-flame burners (50 cubic feet of gas per hour), giving a light of only 200 candles. We deal nowadays with atmospheric burners and incandescent mantles. Does Mr. Matthews not know that a 200-candle power light can be obtained to-day by domestic burners consuming only one-fifth part of the gas mentioned. He appends to the table a note: "The vitiation of the air is proportional to the amount of carbon dioxide it contains." Does Mr. Matthews not know that at different altitudes the chemical composition of the air surrounding the earth varies? But what does he mean by "vitiation?" We should like the term explained, and what it is intended shall be inferred from its use.

Is the author aware that the amount of carbon dioxide that latter-day scientists have found in the atmosphere of enclosed spaces has not the slightest effect on the human system nor on the vitality of that system. If Mr. Matthews studies the human system a little more, he will find that the carbon dioxide content of the lungs is greater than is the highest percentage of carbon dioxide that has ever been found in the atmosphere of an enclosed space. Let him turn to the Neuberg table given on p. 88 of his book, and he will see that this authority states that an incandescent gas-burner evolves 0·02 cubic foot of carbon dioxide per candle power per hour, or 1·05 grammes. Now if we multiply this weight by the 200 candles that is mentioned in the preceding table, does it come to anything like the 3·4 lbs. mentioned there? Let us be fair, and let us be modern. We get resurrected again, on the succeeding page, dear Dr. Meymott Tidy at whose feet we sat and learnt many years ago. Dead upwards of twenty years, his experiments (which do not apply to to-day) were carried out before scientific illumination was really known in the gas industry, and before Welsbach invented his first mantle. May the good old Doctor rest in peace! He would not do so if he was aware that any use was being made, ignorantly or mischievously, of any of his figures that are incompatible with the times. In all modesty, we think if Mr. Matthews reads through the recently issued book "Competition Points for Gas Salesmen," he will see that a deficiency of scientific knowledge on points affecting gas has caused him to vitiate the good parts of his book.

On the question of shop lighting, we find this absurd statement: "But on the main question of efficiency, electricity is far ahead of gas, since for effective display far more light is necessary than a gas installation can give." It is strange, that Mr. Matthews is not (apparently) cognizant of the fact that the range of single units of gas lighting extends from a 16 candle incandescent burner up to a 4500-candle power lamp? Where is the shop that requires more light than a gas installation can give? If he wants a living demonstration of a sufficiency of light, let him go into some of the shopping districts in and about London where there has been a large displacement of electric arc lamps by high-pressure gas-lamps. Then we see the equally stupid statement that the ordi-

* "Electricity for Everybody." Second and Revised Edition. By R. Borlase Matthews, Wh.Ex., Assoc.M.Inst.C.E., M.I.E.E., Consulting Engineer. London: The Electrical Press, Limited.

nary incandescent gas lamp, owing to the greenish colour of the light that it gives, is of very little use for the purpose of matching and selecting coloured goods. Is that why Mr. T. E. Ritchie, Assoc.M.Inst.E.E., found the inverted gas-burner equally as good as the metallic filament lamp for the purpose? Is that why Sir Ray Lankester has found the spectrum of gas-light very similar to sun light? Is that why shopkeepers have so largely chosen high-pressure gas lighting partly for this very purpose of presenting their goods to intending purchasers under a light as near as possible similar to daylight? We see a like statement on the subject of colour again on a later page. If Mr. Matthews will only study the researches that have been made in this connection (including the article by Mr. Thorne Baker in this week's issue of the "JOURNAL"), he will have to qualify the statements in his handbook, if the book is to be a store of veracity.

We should also like to comment on some of Mr. Matthews' statements regarding distribution; but already this article has run out much longer than was intended. There are three or four other points, however, on which there must be remark. He tells us that "owing to the extreme brightness of the higher candle power [metallic filament] lamps, complaints are sure to arise to the effect that the eyes of the user are strained. The complaint would also be made against gas and oil lamps"—mark this!—"were it not for the fact that long experience has caused people to shade these properly." Has not intrinsic brilliancy per unit of incandescent area something to do with the matter? As to cost, it is stated that "experience shows that electricity at 5d. per unit is cheaper than gas at 3s. per 1000 cubic feet." Perhaps Mr. Matthews has not seen that recently we invited Mr. Cramb, of Croydon, to a competition with some 50-candle power inverted gas-lamps that have been running since March 2 last without mantle renewal—that is to say, a photometrical, time, and consumption competition—and any one of these lamps we guaranteed would run on 3½d. worth of gas (at 2s. 6d. per 1000 cubic feet) for 46 hours, against 16 hours for a 50-candle power metallic filament lamp, using a unit of electricity, which at Croydon costs 3½d. Mr. Cramb has not accepted the invitation, under the condition attached that the result should be published broadcast in Croydon, with his name attached to the report. Mr. Matthews gives a table comparing—to-day!—prices for electricity using carbon filament lamps with prices for gas using flat-flame burners; and he says the comparison is practically the same for metallic filament lamps and incandescent gas-lamps. Is it? With a unit of electricity costing (say) 4d., we can, under correct conditions, get about 800 candle-hours, using metallic filament lamps; from the domestic inverted gas-lamps with which we have challenged Mr. Cramb, we can with 4d. worth of 2s. 6d. gas easily get 2640 candle-hours. Where does the relation come in here that Mr. Matthews so airily asserts his figures establish?

We must pass on. Electric cooking, among many other things, is dealt with. There are the same old statements, as to costs, shrinkage, &c. We will not attempt to solve the metaphysical problem as to why electricians' minds have wandered to the belief that with a gas-oven the heat cannot be regulated to any point desired, and a joint be given just the baking time required for producing the same weight of meat from the oven as from an electric-oven. But we will leave these matters at the present at what has been lately said in our columns and in "Competition Points." But perhaps Mr. Matthews will kindly inform us (we should like to know) if he really understands what he is talking about when he says "that the typical electric-oven differs from the common gas-cooker in that the workmanship is better, and it is surrounded by a very thick layer of heat-insulating material which makes it very efficient." The parts of some of the best electric-ovens are produced at the foundries of gas-oven makers; and we deny the statement as to superior workmanship. We are acquainted with electrical engineers who have complained bitterly of the finish of certain electric-ovens on the market. As to lagging, for the past thirty years or so we have used lagged gas-ovens; and the one in use now has been employed for every meal every day for eight years with only a few pence expenditure once for new grill-plates. With a smile, one can pass over the claims for electric heating.

As to power there are also several points we should like to attack; but just one or two comments must suffice. Mr. Matthews would improve the book, for example, by revising the statement on p. 162. No Assoc.M.Inst.C.E. really ought to make himself responsible for saying that a "gas-engine takes about ten minutes to start"—if he is referring to one of modern make fitted, as gas-engines are fitted to-day, with a mechanical starter, and running on town gas. The experience of the British Engine, Boiler, and Electrical Insurance Company does not agree with certain of Mr. Matthews' assertions. In hints to canvassers, we find this reference to the gas-engine

> It wants several times the attention, wears out its parts at a lamentable rate, needs continual overhauling, and emits effluvia that hardly remind one of Araby the Blest. It gaily snorts and clanks away from morning to night using nearly the same amount of gas and water whether running at full load or part, and should it by chance be somewhat overloaded, it promptly strikes work with the airy independence of the mechanic who is employed to nurse it.

We ask Mr. Matthews if that is a worthy statement for inclusion in a technical handbook? We can think of other places where the statement would have greater appropriateness. Referring still to the "hints to canvassers," will Mr. Matthews kindly inform us the names of the gas-experts mentioned in this passage: "When quite new, according to independent gas experts, the ordinary Welsbach mantle with *good* gas gives about 50-candle power; but this *very rapidly* falls off to between 30 and 35 candle power." We also challenge him to quote the "gas advocates alluded to in this statement: "Gas advocates are given to the habit of comparing the latest type of gas light—the Welsbach—with the oldest type of electric lamps—the carbon glow lamp."

It comes to this, that electrical people must accept Mr. Matthews with great reserve where in his handbook he refers to gas. We hope that we may compliment him, if he has a third edition to publish, upon a more thorough revision than is discovered in the second edition. Our columns will be freely open to Mr. Matthews, if he cares to reply to this criticism.

WORKMEN'S COMPENSATION DIGEST.

In legal, and indeed other, circles the letters "B.W.C.C." have come to be recognized as signifying "Butterworth's Workmen's Compensation Cases," which, including the old series of reports, now spread from the year 1899 down to date, and are contained in fourteen volumes. So numerous have the reported cases become under the 1906 and previous Acts, that the time has undoubtedly arrived when a digest—that is, a collection of short head-notes of cases—is not only useful but almost inevitable. The large, well-printed book of some 450 pages before us, is this "Workmen's Compensation Digest,"* compiled by Mr. Douglas Knocker, Barrister-at-Law, who is also, with His Honour Judge Ruegg, the Joint Editor of the regular volumes of reports on this important branch of law.

The preface may very well speak for itself, and describe the object and arrangement of the book. "This digest contains every case of present utility or authority decided under any of the Workmen's Compensation Acts and Rules in the House of Lords or the Supreme Court of Judicature in England up to May 15, 1912," and every such similar case decided in Scotland and Ireland. "The book follows the arrangement of the Act of 1906. The text of the Act is set out, and under every word or phrase that has been the subject of judicial decision are given all the cases bearing thereon. . . . In many instances, the cases grouped under any phrase are preceded by short extracts from important judgments, selected as illustrative of the principles applied by the Courts in their decisions." Thus, under the phrase "personal injury by accident" (section 1 (1)), we get first of all several extracts from House of Lords judgments, such as: "The expression 'accident' is used in the popular and ordinary sense of the word, as denoting an unlooked-for mishap or an untoward event which is not expected or designed" (*per* Lord Macnaghten, in *Fenton v. J. Thorley and Co., Limited* (1903), A.C. 443). And again: "Mere disease . . . not . . . contracted at a particular time and at a particular place by a particular accident," is not an accident (*per* Cozens-Hardy, M.R., in *Eke v. Hart-Dyke* (1910), 2 K.B. 677).

After such general extracts as these, we get sub-divisions of the subject-matter, such as "Suddenness in onset" of accident, under which heading cases are given showing that inhaling gas may be an accident. All through the digest, the cases are arranged in parallel columns, giving (1) those decided in favour of the workmen, and (2) those in favour of the employer. This arrangement constitutes one of the chief features of the book, and without doubt it has considerable practical advantages. A note of warning must, however, be given as to this, where the digest is consulted, as it very usefully may be, by other than lawyers. As is well known, many cases are very near the dividing line, on the one side or other of any given legal principle or authority; and the slightest variation in the facts, or the evidence produced, often results in transferring the particular case from one side to the other. Hence, it must always be borne in mind that the particular facts of each case must stand by themselves; and the reported decisions in previous cases can only be safely used by experts and as illustrations of the application of legal principles to varying facts. This caution is indeed properly implied in the author's preface, where he says: "Some apology may be needed for the arrangement of cases in parallel columns. It must be conceded that this is indefensible on principle . . . but it is felt that the great practical convenience of the arrangement may more than atone for these faults."

Something approaching 800 cases are cited in the digest; but we have only noticed four in which gas companies are the parties actually concerned—the bulk, of course, involving coal, iron, shipping, and constructional undertakings. This possibly may indicate, to some extent at least, the general freedom from accident of gas workers, or the more general settlement of cases that arise in our industry.

The book is pre-eminently a practical one, and space is left for noting-up subsequent cases. It is therefore one which we can entirely recommend to all practical men and managers, who, in their daily industrial pursuits, are brought into frequent contact with claims by their workmen for compensation.

* "Workmen's Compensation Digest, containing every reported decision of present authority . . . under the Workmen's Compensation Acts, 1897, 1900, and 1906." By Douglas Knocker, Esq., of the Middle Temple and South-Eastern Circuit, Barrister-at-Law. London: Butterworth and Co.; 1912. Price 15s.

THE EDINBURGH GAS EXHIBITION.

ONE'S first impression on entering this Exhibition, held in the Waverley Market, is that the building is admirably suited for the purpose of displaying both the goods on the various stands, and the high-pressure lamps by which the building is magnificently illuminated. While passing among the stands, which occupy about half the floor space, it is no doubt warm, owing to the number of gas-stove exhibits shown in operation; but when compared with most of the buildings in which such exhibitions are held, it is certainly much cooler and more airy. The next impression one has is that the stands are somewhat crowded into one corner of the building. This is owing to the fact that a certain amount of floor space has to be left free and available for the purpose for which the place was designed—namely, that of a vegetable and flower market, which is held twice weekly.

The first stand is that of the Gas Commissioners themselves; and it consists of a model house of five rooms—dining room, drawing room, bedroom, kitchen, and bathroom—which are very tastefully decorated. The gas-fittings throughout are of a distinct nature, and all are provided with "Telephos" lighters. The kitchen is perhaps the most novel. In a very large recess, Messrs. R. & A. Main have fitted up an arrangement which should be highly satisfactory to the cook in an ordinary kitchen, or where the device was fitted in a kitchen which was also used as a living room, it would serve the purpose both of heating and cooking, which is the feature of the ordinary coal-range. First of all, there is a gas-fire of Main's St. Nicholas type, which certainly approaches the appearance of a coal fire more nearly than most ordinary gas-fires. Above this is fixed a gas-oven which is at a very convenient height. On the other side is a large hot-plate, and beneath this is a gas-heated hot-water circulator. The only thing one might criticize is that a fire in this position might be likely to set light to the dresses of the cooks; but this would probably not occur, as the gas-fire would no doubt be extinguished when cooking was going on, as the double heat would not be required. The dog grate of the Richmond Gas Stove and Meter Company in the drawing-room, the "Standard" gas-fire of Messrs. John Wright and Co. in the dining-room, the green enamelled gas-fire of the Davis Gas-Stove Company in the bedroom, should all be noted. The bathroom is certainly well supplied with hot water, as it contains two geysers—one of Ewart's, to provide four gallons per minute, and the other of Wilsons and Mathiesons, to furnish two and a half gallons per minute. The towel rail is also heated by gas; and one of Messrs. Fletcher, Russell, & Co.'s water-heaters provides warm water for the wash-hand basin. The hot-water circulator in the kitchen also supplies both bath and basin.

Messrs. Wilsons and Mathiesons also show their "Savoy," "Carlton," and "Granville" fires (the former of which can be supplied if desired with a patented concealable boiling burner), their "Circulator" for attachment to the domestic supply when a coal-fire is not desired, their "Canyon" geysers, and their premier series of cooking ovens, also the "British" washing boiler. The Carron Company exhibit gas hot-plates, cookers, grillers, gas-irons, radiators, and fires of their well-known type, in many styles. The Davis Gas-Stove Company show gas cooking-stoves, green enamelled inside and out, "New Barless" gas-fires, with the tapering fuel and an inset fire for ordinary grates, steamless radiators, with ordinary and luminous water heaters, geysers, and patent R.A.C. greenhouse boilers. Messrs. R. & A. Main make a special point of their "St. Nicholas" gas-fires, as the only ones which look like coal-fires. They also show many of the ordinary types, and the adaptable fire, which fits any modern interior and looks like a built-in fire-place. The Richmond Gas-Stove Company have an exhibit of gas-heated furnaces for re-heating, annealing, &c., and various pyrometers. Messrs. John Wright and Co. show gas-fires with their "Thermo X" fire front, "Sun" gas-heated boiler with patent Thermostat, "Calefactor" and "Garajo" heating apparatus, gas-cookers, and gas-steam radiators. The Cannon Iron Foundries show gas-fires having from 6-inch to 13-inch fire openings, with all parts interchangeable, gas-heated radiators, gas cooking-stoves, and several general domestic gas appliances. Messrs. Fletcher, Russell, and Co. have, besides a number of cooking ranges, gas-fires, and grillers, their wash boilers, tailors' stoves, glue-pot heaters, coffee-roasters, smoothing irons, circulating boilers, flueless, and anthracite stoves.

Messrs. J. & W. B. Smith have a large stand filled with pendants and brackets, &c., of excellent design, and are showing especially their "Imperial" gas-lamp for indoor lighting, and their "Silva" lamp for outdoor use. Messrs. Alder and Mackay are exhibiting their automatic apparatus for lighting street lamps, on the pressure wave system, which has been largely adopted. They have also a number of meters for all purposes, pressure gauges, and other gas-works appliances.

Messrs. Baxendale and Co. have a number of stoves for heating and cooking by gas, gas-fittings, outside lamps, radiators, geysers, &c. They make a special demonstration of the "Fourness" water-boiler for cafés, restaurants, &c.; also their "Beanco" mantles. The Welsbach Light Company, besides a large exhibit of their ordinary burners and decorative lamps, show also the Pharos-Welsbach high-pressure system gas and high-pressure lamps (ranging up to 4500-candle power in one lamp), also compressors for the Pharos gas and air systems. They also exhibit the "Kern" radiators, and, of course, the different brands of mantles which they manufacture.

Messrs. George Hands and Co. show their "Vitreosil" radiators, which are much on the lines of electric radiators, a number of gas-fittings, Hands' "cool" inverted burner, and the "Dreadnought" lamp. Messrs. Krupka and Jacoby's stand contains a number of "Graetzin" lamps of from 200 up to 4000 candle power—the latter with an automatic distance lighter for midnight service, and a compressor directly coupled to an electric motor.

The Gas Commissioners, besides the model house, have on another stand a general exhibit of gas appliances for house and factory purposes. Messrs. Smith and Wellstood have a number of stoves for anthracite, coal, and gas coke. The James Keith and Blackman Company have a compressing plant and lamps of various types, both for public and industrial lighting. They also show soldering and laundry irons for use with high-pressure gas. Eighteen of the high-pressure lamps outside and about the market (representing 136,500-candle power) are of this firm's make. One of the compressors and gas-engines in the general compressing station is also their manufacture. Messrs. R. Laidlaw and Son have samples of their prepayment and wet and dry test-meters, gas pendants and brackets, special samples of gas-cocks and couplings, and pressure-gauges. The Parkinson Stove Company show their "Elysian" fire, with adjustable cornice to fit in most coal-grate canopies, gas heated steam radiators, gas-cookers, and "Maughan" geysers and water heaters with automatic control. Messrs. George Bray and Co. have samples of their various types of burners for incandescent or flat-flame, or for petrol air gas and acetylene, also incandescent mantles and anti-vibrating pendants. Clark's Syphon Stove Company show several patterns of their specialty, and various heating apparatus for trade purposes. The Forth and Clyde and the Sunnyside Iron Company show their new patent "Ardor" fire. The Company have adopted a good plan for showing the adaptability of their fire to ordinary coal-grates, having purchased a number of old second-hand grates, to indicate the steps in the fitting of the gas-fire to the grate. The New Inverted Incandescent Gas-Lamp Company have a large show of their inverted burners, high-power lamps, inside and outside and for shop lighting, with various accessories. M.P. Galloway, Limited, have many engineers' furnishings which will be of interest to gas managers. Messrs. Falk, Stadelmann, and Co. exhibit a large number of fittings, the "Veritas" burners and mantles, glass ware, beaded shades, and their "Ukay" inverted lamp for outdoor lighting. Messrs. Wm. Moyes and Sons are makers of acetylene plants and appliances; and they also have a complete plant for oxy-acetylene welding and a large number of fittings for acetylene. The Wholesale Fittings Company show their "Bonbac" high-power burner, the "Star" inverted burner, which is in use in the streets of Edinburgh, as well as many other fittings, together with glass ware and bead shades.

Messrs. Wood and Cairns, besides a number of fittings showing the "Bland" heat-resisting burners, have also on view a "St. Mungo" gas-fire, invented by Mr. Fyfe, of Glasgow, which is certainly most cheerful and effective. James Milne and Son have a number of pieces of gas apparatus of interest to gas managers, and one of their patent rotary gas compressors driven by a gas-engine. They also have one capable of dealing with 4000 cubic feet per hour, to supply the inside and outside lighting of the exhibition. The Cowan branch of Messrs. Parkinson and W. & B. Cowan, Limited, show models of retort-house governors, station governors, bye-pass automatic pressure changers, gauges, and meters. Henry Bisseker has a large number of gas-burners, fittings, &c., suitable for the general gas trade. Ewart's geysers are shown in many kinds, from ½ gallon up to 16 gallons a minute.

A novel stand is that of A. & J. Macnab, Limited, where laundry work is being carried on with various pieces of apparatus, using gas for the necessary heat. Messrs. A. & E. Podmore and Co.'s patent high-power, low-pressure, and dust and insect proof lamps are to be seen. The exhibit of the Glenboig Union Fire-Clay Company is interesting, on account of the sections shown of vertical retorts made by this firm for the Glover-West system. Sloping retorts and bricks of all shapes and sizes are also shown.

In addition to the exhibit of Messrs. Fletcher, Russell, and Co. of the more popular type, they have also another stand where gas-heated appliances of many descriptions for workshop and laboratory purposes, and workshop tools using gas, may be examined. Like the firm just mentioned, the Richmond Gas Stove and Meter Company have an exhibit of their gas-fires with duplex tap, gas steam-radiators, gas-heated washhouse boilers, cookers, water heaters, and greenhouse boilers. The Bryan Donkin Company are not usually found as exhibitors at gas exhibitions; but in view of the work they are doing in high-pressure lighting, they are showing a small rotary compressor for high-pressure lighting, recording apparatus, regulators, drilling machines, and a number of beautiful models of their manufacture.

A very fine model, showing a colliery with all the apparatus at the pit-head in very great detail, has been lent by the Royal Scottish Museum, and shows the various pieces of apparatus for raising, pumping, ventilating, electric power, and screening. Another model, lent by Messrs. W. C. Holmes and Co., shows a complete gas-works, consisting of retort-benches, condensers, scrubbers, purifiers, meter, gasholder and tank, and governor, with the various mains and connections. The Lothian Coal Company have, besides a number of photographs, plans, &c., actual sections of three of their seams of coal, that of the parrot seam

showing the three component parts—namely, the "Jewel," the "parrot," and the "parrot bottoms." They have also a number of samples of other coals and washed nuts.

A report of the proceedings at the opening ceremony will be found in another part of the "JOURNAL."

LOCAL GOVERNMENT FINANCE.

Taxation Returns Summarized.

MENTION has already been made of the issue of the final volume of the Annual Local Taxation Returns for the year to March 31, 1910. This is Part VII.; and it is a summary and index of the earlier volumes, some of which have been noticed in the columns of the "JOURNAL" as published.

It is the final part of the fortieth annual series of returns issued by the Local Government Board, respecting the accounts of the various local authorities of England and Wales. The local authorities whose financial transactions during the year 1909-10 are here summarized include all county councils, councils of municipal boroughs, councils of metropolitan boroughs, councils of urban districts other than boroughs, rural district councils, boards of guardians, the managers of the Metropolitan Asylum District, the receiver for the Metropolitan Police District, burial boards, the Port of London Authority and other harbour authorities not being commercial companies or private owners, authorities constituted for the purposes of the Unemployed Workmen Act, 1905, parish councils, overseers, and other local authorities who are authorized to levy or order to be levied rates, taxes, tolls, or dues, within the meaning of the Local Taxation Returns Acts, 1860 and 1877. The total number of the separate authorities coming within this definition who had financial transactions during the year is 25,403—counting only once those of them who made separate returns respecting their transactions in different capacities. Full particulars as to the sums received and expended by the Metropolitan Water Board are published in a separate parliamentary paper. The receipts quoted in this summary include the sums received by local authorities from Government grants towards expenses incurred in respect of elementary education, as well as the gross receipts from water, gas, electric light, tramways, and other undertakings carried on by them, and miscellaneous receipts from rents and sales of property and repayments on account of work done for private individuals. Money borrowed to meet capital expenditure is treated separately. The expenditure included is such as has been defrayed out of the receipts mentioned. The number of local authorities who had expenditure (other than that defrayed out of loans) during the year 1909-10 in respect of water supply was 1169, of gas supply 224, of electric light supply 243, and of tramways and light railways 175.

The total amount of public rates received in the year 1909-10 was £63,260,940, of which 24·4 per cent. was collected in areas in the Administrative County of London. The receipts also included £20,914,877 from Exchequer grants (including local taxation duties), £24,618,992 from gas, water, electric light, and tramway and light railway undertakings, and £18,113,813 from other sources. At the commencement of the twelve months, the total of the gross value or gross estimated rental of the rateable hereditaments in England and Wales was £266,944,896; the total rateable value was £215,309,542 (including £23,712,211, the rateable value of agricultural land); and the total assessable value for purposes of the Agricultural Rates Act, 1896, was £203,453,436. Taking England and Wales as a whole, the gross value or gross estimated rental increased between the commencement of the year 1908-9 and that of 1909-10 by £3,907,529, or 1·5 per cent.; and the rateable value, by £2,552,092, or 1·2 per cent. The average amount of public rates per pound of assessable value for the year 1909-10 was 6s. 2·62d., as against 6s. 1·19d. in the previous year, or an increase of 1·43d. Calculated on the estimated population, the amount per head was £1 15s. 9d., as compared with £1 14s. 11d., or an increase of 10d. Exchequer grants amounted to 1s. 11·4d. per pound of rateable value, and 11s. 10·4d. per head of the estimated population.

The loans raised by local authorities during the year 1909-10 amounted to £41,989,630. Of this, £22,570,459 was received by the Port of London Authority; so that apart from this sum, the loans raised by local authorities in the twelve months were £19,419,171, an amount which was smaller than that raised in 1908-9 by £1,230,521, and less than the corresponding amount for any year since 1897-8. The amount of loans received during the year for gas-works was £478,738, as compared with £523,152 the preceding year; for water-works, £2,148,146, against £3,209,880; for electric lighting, £1,147,530, against £1,568,819; and for tramways and light railways, £2,199,399, against £2,374,448. In addition there was an item of £5492 under the head of public lighting; but some of the borrowed moneys devoted to this purpose were entered against gas-works and electric lighting. The amount of loans outstanding increased during 1909-10 by £29,977,719. Excluding from this the £23,109,909 for the Port of London, there remains an increase of £6,867,810—an amount smaller than any annual increase that took place between the years 1891-2 and 1909-10. The total amount of outstanding loans at March 31, 1910 (including £49,529,222 for the Metropolitan Water Board), was £536,002,529; and the amount standing to the credit of sinking funds and other similar funds applicable towards the repayment of such part of this balance as was repayable by means of these funds was £20,487,874.

It has already been remarked that the total amount of outstanding loans at March, 1910, was £536,002,529; and the relative proportions in which this was distributed over the various purposes for which it had been borrowed, are as follows: Baths, cemeteries, electric lighting, gas-works, harbours, docks, piers, canals and quays, markets, tramways and light railways, and water-works, £278,512,094, or 52 per cent. of the whole; undertakings of the Port of London Authority, £23,209,909, or 4·3 per cent.; elementary education, £40,784,868, or 7·6 per cent.; highways, bridges and ferries, and sewerage and sewage disposal works, £101,403,010, or 18·9 per cent.; and other purposes, £92,092,648, or 17·2 per cent. Further dividing the amounts, it is found that £23,247,552 relates to gas-works; £126,980,123 to water-works (including the £49,529,222 for the Metropolitan Water Board); £29,542,515 to electric lighting; and £35,970,463 to tramways and light railways. The average amount per pound of rateable value, over England and Wales, of the total loans outstanding is £1 8s. (including the Water Board loans) for undertakings which are revenue bearing, and £1 1s. 9d. for loans for all other works and purposes.

The total receipts of the local authorities in 1909-10, excluding loans, amounted to £126,908,622. The following are some of the items: Gas-works, £7,484,429; water-works, £4,999,201; electric light undertakings, £3,663,015; tramways and light railways, £8,472,347. The gross revenue of the gas undertakings carried on by local authorities, it is pointed out in the Blue-Book, fell from £7,487,871 in 1908-9 to £7,484,429 in 1909-10. In the case of the electric lighting undertakings, the gross revenue increased from £3,491,040 in 1908-9 to £3,663,015 in 1909-10—sums received for power supplied to the authorities' own tramway undertakings not being included in these figures. The total receipts of local authorities from sources other than public rates, Exchequer grants, and loans, amounted to £42,732,805. The total expenditure, excluding loans, was £125,809,572; and among the items may be mentioned: Gas-Works: Maintenance and other expenses not being loan charges, £5,360,320; loan charges, apportioned as far as practicable, £1,515,485; total, £6,875,805, or 5·5 per cent. of the total expenditure. Electric lighting (other than public lighting): Maintenance and other expenses, £1,342,828; loan charges, £2,180,078; total, £3,522,906, or 2·8 per cent. Lighting streets, roads, &c.: Maintenance and other expenses, £2,212,246; loan charges, £23,226; total, £2,235,472, or 1·8 per cent. Water-works: Maintenance and other expenses, £1,874,441; loan charges, £3,551,877; total, £5,426,318, or 4·3 per cent.

VISIT OF FRENCH ENGINEERS TO EAST GREENWICH.

A LARGE number of the members of the Association Général des Hygienistes et Techniciens Municipaux have been visiting this country during the past week, and inspecting some of the large works connected with drainage, gas, water, electric supply, &c., in London and the provinces; and on Wednesday last a party numbering 35 visited the East Greenwich Gas and Chemical Works of the South Metropolitan Gas Company. The visitors were here received by the Engineer of the works, Mr. F. J. Bywater, who was assisted by Messrs. E. V. Evans, R. H. Collins, T. Kirby, and Dr. Freiss. A booklet in French, illustrated with photographs and plans of the works, had been prepared for the use of the visitors, so that they had no difficulty in following the various processes. The tour of the works was completed by an inspection of the Workmen's Institute, in which must interest was taken; and great admiration was expressed at the splendid arrangements made there for the recreation of the employees.

The guests were subsequently entertained at luncheon in the reading-room of the Institute; and Mr. Bywater, who presided, speaking in French, extended to them on behalf of the Company a very hearty welcome. He said that Mr. Charles Carpenter, the Chairman, and Mr. Doig Gibb, the Chief Engineer, had asked him to convey their great regret at not being able to be present, but an important Board meeting detained them elsewhere. He had also received a telegram from the Chairman and Board of Directors sending their warm salutations, and expressing the hope that the visitors had enjoyed their visit to East Greenwich. Mr. Bywater next went on to explain the Company's co-partnership scheme, which, after 22 years, could undoubtedly be claimed to be a great success. The employees were well paid and contented, and the interests of the shareholders were well safeguarded.

M. de Montricher, in reply, said he and his friends were extremely grateful for the very kind and hospitable way in which they had been received. They had been greatly interested in all they had seen, and especially were they impressed with the particulars which had been given to them of the magnificent scheme of co-operation between the Company and their workmen. He hoped the system would continue to advance everywhere, for it seemed to him to offer the only solution to labour difficulties.

On the proposition of M. Regnard, Secretary of the Association, a message was sent to the Directors, stating that the visitors had been greatly touched by their reception, and offering their sincere thanks to the Board for their generous hospitality.

SELLING GAS IN BIRMINGHAM.

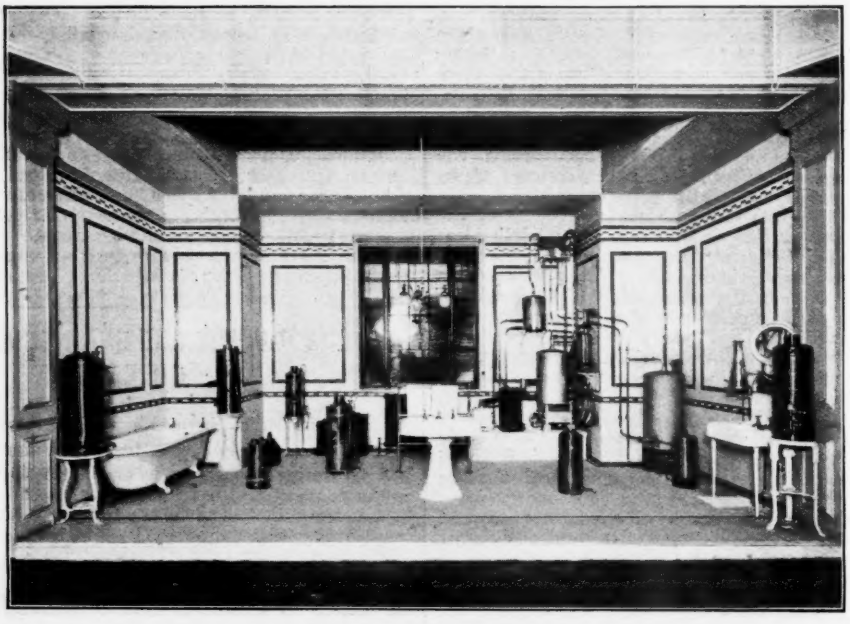
The importance of providing good show-rooms in connection with the selling side of the gas industry is at this time of day widely recognized; but it is nevertheless doubtless the fact that in some cases still more might be done in this direction than has yet been accomplished. As occasion offers, particulars and information appear in the "Journal" which prove how attractive, and how useful from a business point of view, a show-room for gas appliances can be. Notable instances are the paper which was read by Mr. George Clarry, of Cardiff, before the recent meeting of the British Commercial Gas Association, and the photograph that was published in the same issue of the central show-room forming part of the scheme of new offices of the City of Birmingham Gas Department. The period during which Mr. R. S. Hilton has been Secretary to the latter undertaking has witnessed great development of the distribution and show-room movement; he, and those working with him, being determined the public shall have every possible advantage. With a view to supplementing the photograph of the central show-room already referred to, with some information as to what is being done generally in this way by the Birmingham Gas Department, an interview was secured with Mr. S. R. Barrett, the Fittings Superintendent, to whose courtesy in giving details and pointing out features of interest the following notes are due.

The General Scheme.

The gas supply area of the Corporation of Birmingham is a very wide one; and in addition to the central show-room and depôt, there are establishments of a similar character at King's Norton (7 miles from headquarters in the city), Sutton Coldfield (about 9 miles away), and Wednesbury (also 9 miles away)—all being in different directions. The two former districts are furnished with gas from the works in the heart of Birmingham; but Wednesbury and Darlaston receive their supply separately from the Swan Village works. To take matters, as is fitting, in the sequence named, a beginning shall be made with the new offices and central show-room.

Lighting of the Gas Offices.

A description of the offices of the Gas Department in the new portion of the Council House has already been given in our pages; and two or three weeks ago [*ante*, p. 99] photographs and particulars of the handsome gas-fittings were published. On the last-named occasion, reference was made to the pneumatic lighting and extinguishing arrangements, the feature of which is that only one small-sized valve is used to actuate at a distance any number of lights in a fitting. The valve (which is being manufactured by Messrs. Sperryn and Co.) is in this case fixed either under the floor above the chandelier or in the body of the chandelier itself, instead of there being one valve for each burner. The adaptability of this method of distance gas lighting is proved in different portions of the building. In some instances there are chandeliers and pendants provided with pear pushes; in others the push is situated outside the apartment in which are the lights. Still other cases there are in which the lighting and extinguishing can be accomplished from an accessible position on the wall within the room. The burners used are of the "Forward" type, now manufactured by the Welsbach Company. These burners, it is found, cannot light-back; and it is in this way that they adapt themselves so successfully to distance lighting.



HOT-WATER EXHIBIT IN THE CENTRAL SHOW-ROOM.

Artistically designed bronze pillars inside the entrance to the offices, which were manufactured by Messrs. Hart, Son, Peard, and Co., are also fitted with "Forward" burners; the effect being very pleasing. In conjunction with the high-pressure gas-lamps in the main entrance and general office, there is an interesting little arrangement to be seen. By means of a three-way cock, connected with both the high and the low pressure mains, it is possible, according to the direction in which the cock is turned, to supply the lamps with gas at either high or low pressure—an alternative which it might prove useful to have available. The high-pressure burners are by Messrs. W. Sugg and Co.; and the slight hissing noise noticeable when the lamps are first lighted, disappears after a few seconds, and they become quite silent.

In connection with the lighting, no matches anywhere are called for—everything being done by a pneumatie switch or the turning of a tap or lever, so that the high efficiency of modern gas lighting is exhibited in this new building, right through to the end.

The Central Show-Room.

An excellent idea of the manner in which the central show-room at the new gas offices has been fitted up will have been gathered from the photograph (from the department's own Magazine) which appeared in the "Journal" a fortnight ago, p. 225. This show-room covers a floor space of 3300 square feet, is 15 feet high, and has an oak block floor. The brackets, pendants, burners, globes, high and low pressure lamps, &c., that are shown are of all conceivable kinds (many of them connected up), and give a generally attractive appearance to the place. The very best in the shape of gas-fittings is to be seen here, and amid harmonizing surroundings. This is as it should be. Nothing could be too choice to display in the central show-room of a city like Birmingham; and this is evidently the idea that was kept in mind when selecting the goods. A point which is deserving of remark, too, is the excellent ventilation that has been secured.

Down one side of the show-room, there are large recesses; and in one of these—which is termed the bath-room and lavatory section—there is a hot-water system, connected with gas-heated boilers of the Davis, Wright, Potterton, and Wilsons and Mathiesons patterns. As all these heaters are on exactly the same hot water circulating system, it is possible for the department to make reliable tests of the relative efficiency of the different appliances. The whole system is always in practical working order, different boilers being worked on different days, so that the public can make their own choice. There is no overcrowding of goods; and the glazed tiling employed is exceedingly appropriate. There are a number of geysers of well-known patterns; and there is a Stott apparatus (from which boiling water can be delivered instantly), that is valuable for hotels and for restaurants. It is fitted with various safety devices, so that no damage can arise from lack of knowledge. Another new thing is Hanwell's patent bath-heater. This is a boiler holding about 10 gallons of water, which can be heated by a gas-ring with a flexible tube. The boiler is then pushed up to the side of the bath; and on cold water being poured in at the top, the whole of the hot water is forced out. The water for a bath takes an hour to boil, with a consumption of 26 cubic feet of gas; so that at a cost of ¾d., with gas at 2s. 6d. per 1000 cubic feet, it is possible to get a hot bath at any time. The idea is a good one; and, as the apparatus is quite inexpensive, it should prove popular.

Another of the sections is fitted up as a kitchen; and here there

SHOW-ROOM STORES.

are to be seen many types of cookers for culinary operations on both a large and a small scale. The recent reduction in the price of gas in Birmingham is having a very good effect on the consumption for domestic purposes; and this consumption is being further fostered by the thorough manner in which all suitable appliances are placed before the gas consumers of the city. Gas-heated wash-boilers are being introduced largely; one point in their favour being the saving of space in a house by their use. If the estimate is correct, that a whole washing day can be got through efficiently with gas at an expenditure of 4d., there should be a continuing demand for this class of goods. In fact, it would seem to be a field that is well worth cultivating by undertakings that have not yet taken it up. In Birmingham, wash-boilers are let out on hire-purchase, but not yet on simple hire terms.

There are a number of live connections here, also, so that the apparatus can be shown working; and this portion of the show-room has been arranged in such a way that it can be shut off by movable screens, for the delivery from time to time of special lectures to consumers (by invitation).

A Gas-Fan in Operation.

Incidentally, in connection with ventilation, it may be stated that the Gas Department have been making a useful experiment. Difficulty having arisen in connection with the ventilation of one of the lavatories, it was suggested that an electric fan should be installed; but as there happened to be at hand a small gas-driven fan, which could be readily connected up by a flexible tube with the nearest gas point, this was fixed in position within ten minutes of the suggestion being made, with the sequence of perfect success, and the avoidance of running many hundreds of feet of electric wiring.

The Stores.

In the design of the new offices of the department, ample arrangements were made on the ground floor for stores; and the accompanying photographs will give some idea of the excellent manner in which everything has been planned. One shows the fittings stores, and the other the show-room stores, which adjoin the general stores, and contains glass, replacements for stoves, &c. There is also a packing-room for goods purchased in the show-room, situated midway between the show-room stores and the show-room. This is fitted up with a counter, and contains an assorted stock of the cheaper fittings. In fact, it may be regarded as an auxiliary show-room for the moderate priced goods.

An Improvement in Pipe-Couplings.

While passing through the offices, an opportunity afforded itself of inspecting some samples of Mr. Barrett's patent arrangement for pipe-couplings, which has for its object to enable a sound fluid-tight joint to be made between ordinary screwed pipes and socket fittings for gas or water, without the use of paint, hemp, yarn, or anything of the kind. The avoidance of the use of red or white lead, it is pointed out, is a very important matter in connection with new regulations of the Home Office that are about to be issued. The invention consists of a brass internal ferrule, or connecting-piece, in the centre of which is a raised fixed collar. On each side of this collar a lead joint-ring is placed; and when the

FITTINGS DEPARTMENT GENERAL STORES.

pipes are screwed up into the socket or union, these joint-rings (being compressed between the ends of the tubes and the collar on the connecting-piece) are gradually forced into the threads of the socket. An illustrated abstract of the patent specification will be found in the "JOURNAL" for Aug. 15 last year (p. 426). After inserting the nipple, the pipe is screwed in with one pair of tongs, the use of a second pair being unnecessary; and in running a long length of piping, the last pipe that is screwed in can only tighten-up and improve all the joints previously made. There were seen 6-inch pipes and fittings jointed in this manner that had been successfully tested up to 1000 lbs. per square inch water pressure; and also 3-inch, 2½-inch, and 2-inch pipes, with diminishing elbows that had been taken out of stock, screwed together with the Barrett joint, and submitted to a compressed-air test of 70 atmospheres (equal to 1050 lbs. per square inch), without failure. Speaking from memory, Mr. Barrett said he thought that up to 2-inch pipes had been tested, without any leakage, by a hydraulic pressure of 7000 lbs. to the square inch; while with other sizes the pipes had burst, but the joint had always held.

A Standard Mantle.

The department, in conjunction with the Master Gas-Fitters' Association, have just inaugurated a very good scheme. That is, they have arranged to purchase the best type of incandescent mantle that can be procured, and to supply the whole of the trade at a standard price. The mantles will bear a special registered trade mark. As the whole of Birmingham is being districted, each master gas-fitter is sure of the sale of all the incandescent mantles in his area, and knows that the more gas there is used for lighting in his district the better it will be for his business, and so does not become apathetic. The result is that not only have the department their own show-rooms, but they have also the show-rooms of forty-five master gas-fitters, who are all the department's contractors—selling fittings, cookers, stoves, &c., as well as standard mantles. It is a far-reaching scheme, and has required much organization.

King's Norton.

Some particulars of the show-room and branch office at King's Norton, together with photographs of the interior, were given in the "JOURNAL" at the time of the opening earlier this year [see number for May 7, p. 351]; and it is therefore not necessary to go into details now. The population of this part of the department's district may be taken at from 50,000 to 60,000; so that there is plenty of work to be done. The exterior photograph reproduced to-day will show that an attractive building in the Georgian style has been erected; and it is in a first-rate position—facing the tramway terminus, and close to the valve-house in connection with the high-pressure main from the gas-works. In addition to the spacious show-room, and good accommodation for lectures and demonstrations, the depôt serves as a call office for the district fitters. The clerk-in-charge resides on the premises; and his rooms have been fitted up as a model house; gas alone being used for all heating, cooking, and lighting purposes. The counter for the payment of accounts is in the show-room, so that customers may see what is best and newest in the way of gas appliances, even though attending primarily for the transaction of other business. The room also has been provided with comfortable chairs, and ladies are encouraged to make it a *rendezvous* while out upon shopping expeditions.

Sutton Coldfield.

The gas-works at Sutton Coldfield (where there is a population of about 30,000) were purchased over twenty years ago, and the area included in the district supplied by the Birmingham Gas Department. The Corporation have their own electric works; but, by the exercise of constant care and attention, gas more than holds its own. A staff of men is kept employed there; and the local traders are also pressed into the service, so that no heart-burning exists. In one direction electricity is uppermost; for, in spite of the fact that gas is supplied for public lighting at 1s. per 1000 cubic feet, less 5 per cent. (the same rate as Birmingham), the authorities prefer to light the streets electrically, and provide themselves with a load. The depôt is a good example of a small show-room. It is fitted up with the idea of illustrating the home comforts of gas; and a very comfortable little place it is. Here, as has already been remarked in connection with King's Norton, ladies are encouraged to make the office a "place of call," when they can inspect gas heating-stoves of various makes which are let on hire at 1s. per quarter, and fixed free, and gas-cookers which can be had for 1s. and 1s. 6d. a quarter, also fixed free. Cookers of any make, in fact, are fixed free on hire-purchase or permanent hire terms. There is a little store, which, with everything else, is kept in perfect order. Fitters' materials are also served out; from eighteen to twenty men and boys being worked from this branch. An idea of the progress made will be gathered from the fact that last year 700 stoves were fixed, while this year to date the number has reached 600; so that the round figure of 1000 will in all probability be reached by the end of the twelve months. The business is managed by a senior and a junior clerk.

KING'S NORTON SHOW-ROOM AND BRANCH OFFICE.

Wednesbury.

At Wednesbury, there is another good example—this time of a Black Country residential depôt and show-room. The display made is naturally small, but it is in full view of the consumers who come to pay their accounts, and it proves itself to be an efficient "business-getter." The atmosphere in this part of the world is such that it has a disastrous effect on polished brass fittings; so that we see here a nice selection of steel bronzed and oxidized copper goods placed before the customers. Everything is complete, as at the other depôts; a staff of from fifteen to twenty fitters and their assistants being provided for, under the charge of the Local Superintendent (Mr. F. W. Deane), who has the services of a couple of clerks. Gas-engines and compressors provide a nice little display of high-pressure gas-lighting in the Market Square. The bulk of the growth of late years in this district has been due to slot-meter installations. For these consumers a cooker is fixed free, and piping run if necessary; the amount of gas supplied being 35 cubic feet for a penny if the department put in gas-fittings for lighting, and 39 feet if the consumers provide their own fittings. At Wednesbury, part of the public lighting is electric; there being a municipal electricity station, where current is generated by means of Mond gas supplied at a very cheap rate. Still, however, gas continues to forge ahead. Though Wednesbury and Darlaston (with a population of about 45,000) are supplied separately from Swan Village, the gas consumers enjoy exactly the same advantages as those in Birmingham itself, and pay precisely the same price.

A Temporary Show-Room and Lecture Hall.

Passing through the Market Square at Wednesbury, attention was drawn to a shop in which the useful but unexciting business of a clothier is now carried on. A short time ago this shop was empty; and its prominent position led the Gas Department to temporarily rent it, for the equally useful and more interesting purpose of demonstrating to the residents the capabilities of gas in the home. Miss Edith Lewis, who is the Principal of the

A TEMPORARY SHOW-ROOM AT WEDNESBURY.

Wolverhampton School of Cookery, gave a successful series of lectures, extending over a fortnight; the whole of the interior of the shop being fitted up as a lecture hall. In the windows were exhibited various modern appliances for the utilization of gas; and these, owing to the prominent position of the shop, received much attention at the hands of the public. The outside lighting was by the high-pressure gas which is supplied to the Market Square by the department; and the interior on the low-pressure system. The appearance of the place will be judged from the illustrations. It was eminently suited to the object in view, and was such an installation as could be fixed up by a small gas undertaking, at a cost for establishment, Mr. Barrett estimates, of about £50.

Literature.

A special feature is, of course, at all the show-rooms made of literature on the subject of gas apparatus and its use. This is spread out on the centre tables, in order that visitors can see at a glance if there is anything likely to specially interest them—and, if so, take a copy. One temptingly got-up little pamphlet deserves special mention. Bearing the title of "A Few Hints on Gas-Burners," it deals in a chatty way with facts that consumers, or prospective consumers, might like to be informed upon. Following some comparisons of cost of different styles of gas-burners, attention is drawn to the importance of buying the best burners and mantles. Then instructions are given (with illustrations) for the cleaning of both inverted and upright incandescent burners, and for the fixing of new mantles.

The Training of Gas-Fitters.

The advisability of seeking out faults instead of waiting until complaints come in from consumers, is thoroughly recognized in Birmingham; and consequently this is what is aimed at. The active policy favoured requires, of course, for its carrying out a large staff of well-trained men; and to provide this proper steps have been taken. Through the present session, three courses of lectures are being given at the Birmingham Technical School. The first is termed the commercial class, in connection with which lectures are given to the staff in all branches of this section of the industry. In the second class, lectures are given to mechanics and mechanics' assistants; and the third consists of mechanical drawing lessons to gas-fitters' assistants. In addition, there is at the gas offices a practical course of handicraft teaching in relation to gas-fitting. Both these latter classes have been found to be absolutely necessary, in consequence of the decay of the system of apprenticeship which used to obtain in the trade. With the constant forward movement, and the many improvements in appliances used in modern methods of manipulating gas, the knowledge of the workmen is found not to keep pace with things; and so schools have become requisite. Mr. Barrett has some hopes that later on it may be possible to come to some arrangement with the trade whereby there will be a return to the old apprenticeship system. All the teachers in these classes are the employees of the department, so that the teaching is on the lines that the Corporation want their work done.

On Thursday, Alderman Sir Hallewell Rogers, J.P., distributed prizes to seven youths who last year showed the greatest progress in the drawing branch of the school; these prizes being awarded, not so much for quality of the work done, as for the improvement displayed by the student during the course. In each case the prize was accompanied by a certificate which should be helpful to the recipient in obtaining employment. The classes are open not only to the department's own youths, but to those employed by master gas-fitters as well; and among the prize-winners, one of the outside youths has distinguished himself. The fact that the awards have been made for meritorious effort and not necessarily to the most able competitors, has made the students very keen this year.

SUGG'S NEW LIGHTING FITTINGS.

We give to-day illustrations of three new designs of gas-lighting fittings which have just been introduced on the market by Messrs. William Sugg and Co., Limited.

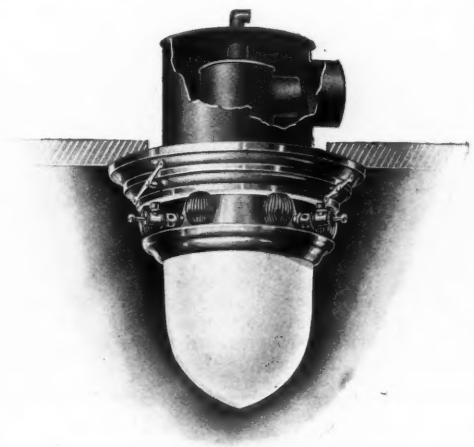


Fig. 1.—Ventilating Gas-Lamp.

Fig. 1 is a ventilating type of gas-lamp, fitted with three 4 cubic feet burners (each having gas and air regulators), which give a light of 400-candle power. Efficient ventilation is maintained; and the products of combustion are conveyed to the atmosphere by means of the double flue arrangement shown in the illustration. The lamp is made in several artistic finishes; and is suitable for the lighting of public shops, offices, &c.

Fig. 2 shows a fitting for semi-indirect lighting which has been so designed that a portion of the light passes through a ground-

glass bowl; the remainder being reflected from the ceiling. This arrangement produces a well-diffused soft light without any glare. The necessary flexible tubes for conveying gas to the burners are so neatly worked into the suspending chains as to be quite inconspicuous.

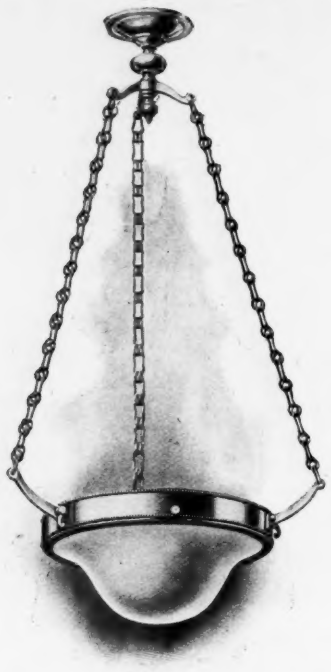


Fig. 2.—A Fitting for Semi-Indirect Lighting.

Recognizing the increased attention which is at present being given to the subject of shop-window lighting—the aim being to conceal the sources of light, and illuminate by means of reflected light the goods displayed—Messrs. Sugg have introduced the lamp

Fig. 3.—A Shop-Window Light.

shown in fig. 3. It consists of either four, six, or more No. 2 burners arranged within a copper casing, enamelled black on the outside, and lined with fluted mirrors. One or more of these lamps fixed out of sight, well forward above the window, will throw the goods into strong relief.

Manchester and District Junior Gas Association.—As briefly announced by the Hon. Secretary (Mr. J. Alsop) on the occasion of the delivery of the first Manchester University Lecture (*ante*, p. 226), the members of the Association have been invited by the Chairman and Gas Committee of the Stockport Corporation to visit the Stockport Gas-Works next Saturday afternoon. There will be several features of interest awaiting their inspection, including inclined retorts, coal and coke handling plants, telpher plant, a reinforced concrete tank, and a two-lift column-guided gasholder undergoing enlargement into a four-lift cable-guided one—the third lift being now in course of erection. Tea will be provided by the Committee; and in the evening a meeting will be held for a discussion on the subject of "Wet Purification of Coal Gas," to be opened by Mr. C. E. Woodhead, of Manchester.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Opening Meeting.

The Opening Meeting for the present session of the London and Southern District Junior Gas Association was held on Friday evening, at the Westminster Technical Institute, Vincent Square. There was a very large attendance of members and visitors. The chair during the first portion of the proceedings was occupied by Mr. D. J. Winslow, of Lea Bridge, the President.

Arrangements for the Session.

The President, in the course of a few general remarks, said that a special feature of the new session was the Reception Committee which had been formed. This consisted of the officers and Council, who would wear a distinguishing badge, and would place themselves at the disposal of any new members. In an Association of this kind, numbering about 190 members, it was quite impossible for the President and officers to get in touch at once with the whole of the new members, and therefore the Reception Committee had been instituted. Since the last meeting 27 new members had been elected, and eight were awaiting election. A special course of lectures was being arranged at the Technical Institute, details of which would be announced later on. The Council of the Association had had the matter in hand for some time, and approached the Principal of the Institute with a view to being enabled to associate themselves with the developments in gas engineering and supply. The Principal had taken up the matter heartily, and was only too pleased to support the Association in this class of work. The lectures would, of course, be arranged between the Principal of the Institute and the London County Council. Another special feature of the programme was the address they were to have that night from Mr. W. Doig Gibb, the Chief Engineer of the South Metropolitan Gas Company, to be followed later in the session by one from Mr. Thomas Goulden, the Chief Engineer of the Gaslight and Coke Company.

An Address by Mr. W. Doig Gibb.

The President then called upon Mr. Doig Gibb, who delivered the address which (with the remarks to which it gave rise) will be found on pp. 360-63.

The Patrons and Visitors.

The President remarked that, in addition to the hon. patrons who had addressed the meeting, there were a number of visitors present—including Mr. Head, Mr. Stokes, and Mr. Austin, of the South Metropolitan Company.

Mr. S. A. Carpenter proposed a vote of thanks to the patrons and visitors present; and this was seconded by Mr. T. F. Canning, and carried unanimously.

Mr. Goodenough and Mr. Cross responded.

Mr. Winslow's Presidential Address.

Mr. Gibb then took the chair, while the President delivered his Inaugural Address. This is given on pp. 365-70.

At its conclusion, Mr. Gibb said they had had a most interesting address, and regretted that the lateness of the hour had compelled the President to somewhat hurry matters. The colour portion of his remarks appeared to open up a new field.

It having been agreed to discuss the address at the next meeting,

Mr. J. G. Clark proposed a hearty vote of thanks to the President. Mr. Winslow, he said, had pointed out the necessity of taking the colour of light into account when speaking of co-efficients of reflection. He believed this was the first occasion on which this fact had been put on record. Mr. Winslow was the first man he had found to give the idea that co-efficients of reflection could not be stated except with reference to the colour of the light that was used.

The Hon. Secretary (Mr. E. Scears) seconded the vote, which was carried with applause, and acknowledged by the President.

We have received from the Belgian Gas Association the first "Bulletin" of the series which it has been decided to issue periodically. The contents consist for the most part of an account by Heer Van Heede of a visit paid by certain members of the Association in July last to gas-works in England, for the purpose of inspecting the improvements effected in the Woodall-Duckham system of vertical retorts since the starting of the new gas-works at Lausanne. An illustrated description of the system is given. The other matter comprises translations of articles which have appeared in the "Journal" on Dr. Bone's process of surface combustion, and on Mr. D. Chandler's apparatus for automatically recording the specific gravity of gas; also of an article in the "Journal für Gasbeleuchtung" by Herr Volquardts on the subject of water-gas tar for the absorption of naphthalene, and an extract from M. Laurain's paper, read at the last congress of the Société Technique, describing M. Sainte-Claire Deville's apparatus for estimating this constituent. These two subjects have been dealt with in the "Journal." The "Bulletin" is produced under the direction of the standing Publication Committee of the Association; and they invite the co-operation of the members in keeping up its interest and utility by submitting communications for their acceptance.

GASLIGHT AS AN IDEAL ILLUMINANT.

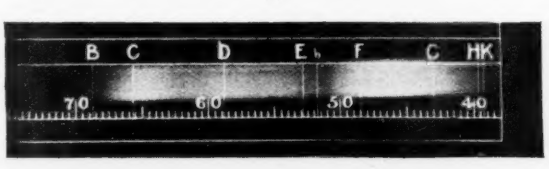
By T. Thorne Baker, F.C.S., F.R.P.S.

It is a somewhat curious fact that gaslight has hitherto been rather neglected from the ideal illuminant point of view, because incandescent gaslight particularly lends itself to the production of artificial daylight—that is, an illumination which, from a hygienic and physical standpoint, is as nearly as possible the equivalent of sunlight. In the case of metallic filament electric lamps, considerable care has to be exercised in order to make the filaments as little brittle as possible; and chemicals cannot be very easily employed for the sole purpose of altering the spectrum of the light produced. In the impregnation of incandescent gas-mantles, however, substances may be readily employed to affect the spectrum. But, on the present occasion, I propose to deal more especially with the screening or filtering of ordinary light for purposes where artificial light which is approximately the equivalent of sunlight from the physical point of view is required.

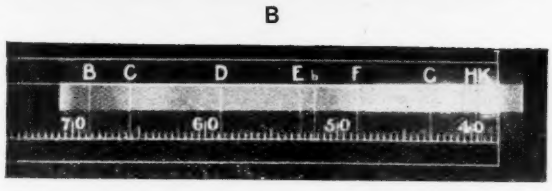
There is a growing demand for light which, as far as is compatible with general practice, conforms with the requirements of the ideal hygienic light—that is, normal daylight; it being only reasonable to regard sunlight as best adapted to human needs. All artificial illuminants possess too much or too little of one or more of the colour constituents of white light. Thus, obviously, candle light is yellower than daylight, incandescent gas is somewhat greener, and arc light is too rich in violet, and so forth. By placing colour screens of complementary colour in front of the light, we can suppress the excessive rays; so that by screening candle-light with a filter of the correct shade of blue-violet, we should obtain pure white light, and so on. One of the first questions of commercial importance is what percentage of the light will be lost or absorbed in the screening? This will depend largely on whether we screen it so as to produce spectroscopically accurate light or whether we compromise by screening the light so as to be white enough for all ordinary purposes. In the latter case, a moderate percentage (say, from 20 to 30 per cent.) only need be lost in the case of incandescent gaslight; and this amount might be still further reduced if sufficient attention were devoted to the study of the impregnating constituents of the mantles.

The only satisfactory way of comparing one illuminant with another is by means of the spectroscope. If we have a comparison prism fitted, we can observe the spectrum of one illuminant above that of the other; and by the use of a shutter, which cuts off all but a narrow piece of the spectrum, we can compare, one after another, the intensity or brilliance of each consecutive portion of the entire spectrum from violet to red. If, further, we have some device by which we can reduce the intensity of one beam, we can then observe and compare the two spectra, portion by portion—reading off the dimming necessary to make the two appear of equal luminosity for each portion in some recognized units. Thus with the Hüfner spectrophotometer, in which the spectrum to be compared is dimmed by means of crossed nicol prisms, the readings are measured in terms of the square of the cosine of the angle through which the second nicol is rotated.

A



B



Distinct maxima will be seen in A at the red region around C, and the green between D and *b*.

In the photographs shown above, we see two spectra—A that of the spectrum of incandescent gas; B, the spectrum of arc light. A wave-length scale is reproduced in contact with each spectrum, the visible spectrum including, roughly, the wave-lengths between 3900 in the violet and 6900 in the red. Suppose we divide this up into fifteen equal portions, each representing 200 units, we can then make fifteen comparative readings, from which a curve can be plotted showing the relative luminosity of the various portions of each spectrum. From a comparison of the photograph, it is seen that the arc is richer in violet, and the incandescent gaslight is comparatively richer in green and red. We can obtain a working comparison by reading the densities of each division of the spectrum in each case in the negative photographs, or, better still, by reading off the relative intensity of the illumination in each portion by the spectrophotometer, as already suggested.

In the present article, I do not propose to deal with the technicalities of these photometric measurements. The object is to point out that comparisons of incandescent or other gaslight may be made with the arc or metal filament lamps, or with daylight—the inevitable standard. Having obtained these comparisons, and with the further use of the instruments in question, it is a matter of experiment only to produce filters which will screen the light so as to render it physically equivalent to daylight. The preparation of the light filters or screens, as well as the examination and comparison of the illuminant, are matters which have already been described in journals dealing with illuminating engineering.

Aniline dyes, although not invariably permanent under the influence of the heat of the lamps, are best suited to the preparation of the screens. Stained gelatine films bound up between two fairly thick cover glasses give the most satisfaction, or one of the glasses may be coated with a gelatine film which is afterwards stained and dried; the film then being bound up with a second covering glass. The tinting of the globes in their manufacture would, of course, be the ideal method for screening; but to obtain a satisfactory result in this way anything like spectroscopically correct would be extremely difficult. By combinations of the dyes crocein scarlet, napthol green, methylene blue, and methyl violet, a filter can be prepared for most illuminants which screens the light sufficiently to meet all ordinary demands. In cases where artificial daylight is required for illuminating a table or desk where colour sorting or matching is to be done, I have usually employed one or two incandescent gaslights with large square glass filters held by metal stands in front of them, so that the rays of light falling on the table must pass through them. But the methods of preparation must be left to be dealt with on a future occasion. With ordinary incandescent gas and suitable filters, I have done a considerable amount of satisfactory work, obtaining a fairly pure white light—artificial daylight—with a very moderate sacrifice in the amount of light wasted by the absorption of the screen.

In some commercial work at present being carried out for a firm who require "daylight" illumination, incandescent gas has been given the preference over electric light, for the reason that the latter, when incandescent lamps are used, varies so largely in its spectrum composition, with the inevitable variations in voltage. Any usual change in the gas pressure is of far less consequence; and for industrial work where continuous daylight is required, it has been adopted with great success.

GAS UNDERTAKINGS AND CO-OPERATIVE EFFORT.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The arguments advanced by the respected Chairman of the South Metropolitan Gas Company, in support of his determination to withhold his personal and official support from the British Commercial Gas Association (*ante*, p. 232) read something like putting the clock back more years than one cares to mention.

At the time when Gas Managers' Associations—the pioneer of co-operative as distinct from individual effort—were inaugurated, it was a usual thing to meet with parties who had no sympathy with the movement, and objected to identify themselves with it by membership, on exactly the lines laid down by your correspondent: (1) That they had already thoroughly cultivated all the ground, so far as their own district was concerned, that could possibly be covered by the Association; and (2) they objected to anything in the way of publication of their methods, on the ground that the same might get into the wrong hands and be used against them. Going further back, there was a time when not only the publication of a printed report of the accounts by circulation among the shareholders, or a report of the annual meeting in the local paper, was for similar reasons held to be injudicious, but information was withheld from neighbouring gas undertakings. The Chairman, in his annual speech, was adjured to avoid saying too much; and he usually accepted the advice. This may have originated in the days when competition was rife, when there were three or four lines of main in one street, and the prospect of an additional one at any time; but it survived that period by a long while, and is evidently not entirely extinct to day.

At the time when, as the Hon. Secretary of the South-West of England District Association of Gas Managers (now merged in the Southern Association), I was interested in increasing the membership and influence, there was one town where we could never get a footing. The Engineer would not become a member, or even attend one of our meetings as a visitor; and his Directors, no doubt at his instigation, refused to allow such official recognition as is implied by the use of the Company's board-room as a place for one of the ordinary meetings. This was the only instance, by the way, where the Association was refused the use of a board-room. In the hope of altering this decision, the President for the year accompanied me on a personal visit to the Chairman and Engineer. But our mission was not a success. We received a kindly and hospitable reception; but our Association was refused recognition exactly on the grounds above indicated. At the same time, members when calling in a personal capacity were promised every possible attention. There is a striking example here of the oft-quoted saying that "history repeats itself."

Although the advocacy and adoption of commercial methods in the sale of gas may be a novelty to many members of the British

Commercial Gas Association, it is possible to go back considerably beyond the twenty-four years mentioned by Mr. Carpenter, and to find examples, both as regards preaching and practice, of enterprise in the way of educating and of getting in touch with consumers. Starting with the first volume of what is now the "JOURNAL OF GAS LIGHTING," we do not go very far before finding indications of such a policy. And this at a time when there was practically no special necessity for pushing business, and no competition much worth the name. On the other hand, there were no enterprising firms of manufacturers with complete laboratories and testing-rooms, or having sets of suitable leaflets or pamphlets at the service of any company. All the advertising and printed matter had to be arranged at the gas offices, and a considerable part of the apparatus and fittings required had to be put together at the gas-works. But it is not necessary to quote examples of engineers who in spite of these disadvantages made very fair progress on the lines of commercial enterprise.

There has always been a certain amount of feeling in favour of individual as compared with collective effort, not only among directors, but also among officials. As instanced above, it was held that the place for the manager was at the works office, or at any rate in the district, and that the Association meeting was not altogether unassociated with what one class of the community calls a "jolly old beano," and another a reunion. We were told that champagne and an eight-course dinner were as much in view as technical improvement, and that the recreative side of the question was the real object; the reading of papers and discussions being merely a farce. Others who did not go so far as this held that the manager's time would be more profitably employed, from the company's point of view, in his daily round than in associating with his colleagues; and to this day there are some who, if they attend the Association meetings at all, have to take it out of their holiday time. This argument, to be consistent, should be extended to technical literature. If it is not worth while spending time in hearing about and discussing what others are doing, why waste an hour in reading about it?

At this time of day, there are many who have tried both methods and proved which is the better. The best answer to the exclusive stay-at-home kind of argument is to be found in a comparison of the gas industry as it stands to-day, with its position at a period when it was the exception for the manager to be a member of an Association, when there were no Commercial Sections, and no British Commercial Gas Association; and to compare the work done for the industry by our leading Association men with that effected by the typical stay-at-home.

At one time, I held the view that, as far as comparatively small gas undertakings were concerned, there was no need for a Commercial Association, as they could put a good man on the district, and practically saturate the demand for gas—in this way obtaining similar results to those gained by Mr. Carpenter's very competent arrangements for the South Metropolitan Gas Company. But I have recently been strongly impressed with the fact that the old-fashioned notion about quality and cheapness making its way unaided, only applies where there is not an opposition shop. It may be true that "good wine needs no bush;" but what is to be done if an influential body of financiers, scientists, and commercial men are banded together to prove that the wine is bad? This does not apply specially to the sale of gas, but to anything that is marketable. There is not only the customer to consider, but also the opposing element. A senseless beating of the big drum does not meet the case. Whatever we may have to sell, an efficient service and intimate contact with the customer is a *sine quâ non*. The "early bird catches the worm;" and the first man who comes along very often gets the business, and that irrespective of the merits of his commodity. Prompt attention to complaints does not entirely cover the ground to-day, if it ever did so, for people will not "complain"—that is, not at the proper place. They do not like to find fault at the gas office; while they have no objection at all to running down and uttering all sorts of innuendoes against the company and their officers in an irresponsible way. Give me a district that has a clean sheet on the complaint book for the last six months, and I will undertake to bring in a score of genuine complaints in the course of a few hours. One man in a thousand may be equal to dealing with all these matters single-handed, but the remaining 999 will do well to avail themselves of the present endeavour to promote co-operative effort.

Like many others, I recently adopted the plan of sending a qualified lady inspector to make a house-to-house visitation, and to examine and report upon the cookers out on hire, in respect to such matters as whether kept in good condition, regularity of use or otherwise, defects if any, &c. The effort was confined to the existing customers, and did not include canvassing or any direct attempt to get new ones. The report is a useful document, affording information that could not be obtained by the regular staff. But the result has proved a decided stimulus to the cooker department, and has led to many new customers. It is so far satisfactory as to indicate that a wider extension of the idea would be a profitable proceeding. A competent representative might take the district through from A to *Z*, and find out the defects, the difficulties, and the requirements of customers to an extent that the present organization cannot attain. It would be his business, not only to look after existing custom, but to keep in touch with the prospects for new. He would have a proper register, showing size and length of service supply, particulars of meter, leading details of the supply system, number of points and consumption at each point, &c. The card system is particularly applicable to this purpose. If before arranging to deal with a complaint, the foreman could obtain full information on these matters, he would be greatly assisted towards a competent and really satisfactory remedy, especially in regard to overworked, worn-out, or badly-designed supply systems. I may be reminded that this is over-stepping our legal rights and powers. It is a curious anomaly that, while the tendency is decidedly towards holding the gas-works staff responsible for any and every defect up to the point of supply, the legal point of control ceases at the outlet of the meter. If a consumer chooses to cook his supper, warm two or three rooms, and run a dozen or more lighting burners through a long one-inch service and 10-light meter, and curse the gas company as incompetent or negligent because the supply occasionally flickers, there is no legal remedy. The consumer who talks so loudly to-day because the gas company do not make his old and possibly defectively designed fittings afford results equal to new and up-to-date systems, probably is not aware, or does not remember, that fifty years ago when gas companies sought control up to the burner they were strongly opposed, as it was supposed, in the interests of the public. But it will not do to lie quietly by, accept the position, and leave the dissatisfied consumer to fall a victim to some brand new system, fitted up with strict attention to, and suited to the quality and quantity of, his requirements. The results obtained by the new, will be compared with those that they have displaced, to the great and, it should be added, grossly unjust disadvantage of gas. Then there is the question of advertising. I hold that a large amount of the matter for the local press can be better written-up by the staff of the company who are, or at any rate should be, in touch with local circumstances, than by a skilled professional advertisement writer from a distance who possibly has never seen the place. But for posters and illustrated catalogues, the Commercial Association has already shown that it can go not one better, but one hundred better, than individual effort.

These and many other problems that have lately arisen call for co-operative effort in a way that has never before been so evident; and the exclusive stay-at-home who attempts to tackle them off his own bat is at a great disadvantage.

REPAIRS AND MAINTENANCE IN GAS-WORKS.

PART I.

By a WORKS ENGINEER.

MODERN systems of carbonization have in many cases so cheapened the cost of manufacturing gas that it is by no means unusual to find that quite half the works costs are represented by "repairs and maintenance" charges. With the good prices now ruling for residuals, the net coal figure is sometimes a "credit" instead of a "debit" item. Carbonizing wages are often no more than 1·50d. per 1000 cubic feet; salaries rarely amount to 0·50d.; purification is (say) 0·25d.; leaving as much as 4d. for repairs and maintenance. Thus the latter item becomes quite unwieldy, and is seen to be totally disproportionate to the remaining items upon the expenditure side.

Years ago, with hand labour, 4d. per 1000 cubic feet was commonly the cost of carbonizing wages, 1d. or more would go in purification, and (say) 3d. in repairs and maintenance. At that time, the latter item was quite in keeping with the rest of the expenditure, especially as net coal, with high fuel accounts, would amount to 4d. or more. It is not as though this figure actually represents repairs and maintenance and no more; in reality, it includes a good deal which should come under the heading of "general manufacturing expenses" (were there such an item); under "extensions, improvements, and additions;" or under a "general purposes" heading. For instance, Is there any rhyme or reason in placing under the heading of repairs and maintenance wages paid to gatekeepers, watchmen, messengers, syphon men, weighers, yard sweepers, and many other necessary members of a works staff? In this way the figure becomes swollen to an unreasonable magnitude.

The writer considers that the repairs and maintenance item, as now understood, should be divided into four separate items, as follows:

1.—Repairs and maintenance.
2.—Manufacturing charges (as distinct from carbonizing).
3.—General purposes.
4.—Extensions, improvements, and additions (not chargeable to capital).

The first item should be strictly the wear and tear of buildings, plant, roadways, &c.

The second item should cover expenditure, such as wages paid to valvemen, engine attendants, syphon men, boiler men, pump attendants, and others directly concerned in the manufacture of gas, as distinct from those engaged in carbonizing operations. Carbonizing wages would then be limited to retort-house men.

In the case of No. 3 (general purposes), there would be included wages paid to men who are not directly concerned in either carbonizing or manufacturing operations. Under this heading would come gatekeepers, watchmen, messengers, office staff, weighers, sweepers, &c.

Heading No. 4 would cover money spent on the class of improvements, extensions, and additions, which are always proceeding in progressive gas-works. It is a fairly general practice to gradually improve works and plant from year to year without

apportioning any expenditure to capital account. In addition to more important improvements, such small matters as tiling an engine room, replacing a corrugated shed by a brick building with slate roof, paving a road, the addition of windows and skylights to existing buildings, and similar small improvements, together amount to a substantial figure in the hands of a works engineer who is keen on the appearance and efficiency of his works.

Expenditure on repairs and maintenance is the amount expended in keeping the works in a thoroughly fit state for the manufacture of gas; and any additional sum spent on improving the existing buildings or plant should not properly be apportioned as repairs and maintenance. It may, of course, be argued that as there is in gas-works accounts no provision for depreciation such expenditure under the heading of this item is fully warranted, as otherwise the value of a works is diminished year by year. This is quite correct; and it is difficult to determine how provision is to be made against depreciation unless the repairs and maintenance are debited with some of the cost of extensions and improvements. Nevertheless, it is a slipshod way of providing against the depreciation which must assuredly take place in every gas-works. Two wrongs never make a right; but until a depreciation fund becomes a recognized item in gas-works accounts, careful engineers will very rightly charge a large proportion of expenditure on extensions and improvements to revenue account under the heading of wear and tear. The advisability of showing expenditure on extensions, additions, and improvements as a separate item must, therefore, remain a question of expediency.

The difficulty at the present time is, of course, the impossibility of limiting the various charges involved in the manufacture of gas to the five items specified in the Gas-Works Clauses Act, 1871. Each engineer and secretary has his own interpretation of what items should be included under the five headings. The result, for comparative purposes between one works and another, is chaos, as might be expected.

The writer makes a practice of dividing-up both the wages and materials into the above headings; and it is not too much to say that the information thereby gained is invaluable. The expenditure on extensions, additions, and improvements does, of course, vary enormously from year to year. The remaining items, and especially those classed as "manufacturing charges" and "general purposes," vary to a comparatively small extent, depending largely on the amount of gas made. This system, however, enables one to quickly detect where expenses are increasing, and, if necessary, to remedy any unusual extravagance in any particular direction. The "repairs and maintenance" item is further dissected into a number of minor divisions, as will be shown later, both in wages and materials. The comparison of such figures year by year enables a thorough grasp to be obtained of the necessary items of expenditure. The following are actual figures for twelve months in the case of a works manufacturing 1000 million cubic feet of gas, of which 28 per cent. is carburetted water gas:

	Per 1000 Cubic Feet. Pence.
Extensions, improvements, and additions	0·500
Manufacturing charges	0·558
General purposes	0·272
Repairs and maintenance (*a*) Wages	1·177
Repairs and maintenance (*b*) Materials	0·844
	3·351

"Manufacturing charges" include boilermen, engine attendants, valve men, pump men, syphon men, and a portion of the supervising staff; it also includes the removal of rubbish, boiler ashes, and clinkers. "General purposes" consists of gatekeepers, watchmen, storekeepers, weigher, sweepers and cleaners, timekeeper and clerks, messengers, and a portion of the staff. It should be explained that the description of "extensions, improvements, and additions" only refers to such expenditure as would usually be included under the ordinary wear and tear heading, but which is not actually either "repairs" or "maintenance," but is in reality what its description implies.

It will be seen that the actual wear and tear in this case does not amount to so large a figure as is usually charged under this heading. This is because it is not loaded with all classes of expenditure having no connection with it. The two items "manufacturing charges" and "general purposes" include expenditure which is at present often charged more or less indiscriminately to carbonizing wages, coke, coals, or wear and tear.

GASLIGHT AND COKE COMPANY CENTENARY.

AN APPRECIATION.

[COMMUNICATED.]

DURING the past few months, much has been said and written with regard to the now well-established forward policy of the premier Gas Company in the Metropolis, who are this year celebrating their centenary. In connection therewith, the honoured name of the Governor of the Company, Mr. Corbet Woodall, has been freely mentioned as the one chiefly responsible for this policy, and that the date of his advent to the office of Governor synchronized with the commencement of this policy. Though this is quite true with regard to the date when the Company, with their new head, started on their active campaign, both within and outside the administrative Board Room, it is far from being so with regard to the author of the policy himself. Dr. Corbet Woodall, to give him his proper title, who, more than a quarter-of-a-century (to be correct, 27 years) previous to his election to this high administrative office, was then in the very midst of the fighting arena, waging the battle of gaslights against the then newly-introduced illuminant, at which time a great deal of energy and ingenuity were displayed in conducting the interesting controversy on the respective merits of gas *versus* electricity. The "Daily News" in January, 1879, speaking in regard to this as "a gas-retort," said:

> It has at length occurred to a gas company to give a practical illustration of what gas can do if it be fairly dealt with. The promoters of the electric light have recommended it to the public by the simple expedient of displaying its powers in the public thoroughfares, and for some months they have had it all their own way, mocking the puny gas-lamp lights in the Strand, on the Embankment, and on Holborn Viaduct with globes of glorious light. After a period of apparent paralysis, the gas companies are beginning to take courage. There is no question of the superior brilliancy of the electric light as applied to street illumination. But behind looms the question of cost; and the dark shadow of the ratepayer is a deterrent influence on street illumination which the most powerful electric light yet known has not succeeded in overcoming. This is the weak point in the attack of the advocates of the new light, which the gas companies have not been slow to see, or diffident in insisting upon.
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> The streets of London are lighted in accordance with contracts between the various gas companies and the vestries. Gas is sold at so much per foot; and the vestries get just as much as they are inclined to pay for. The vestries, having the wholesome fear of the ratepayer in their eyes, are chiefly anxious to keep down the rates; the gas companies, having dividends to pay and new shares to issue, are careful not to give a foot and a quarter of gas for the price of a foot; and between the two London is very badly lighted. But it is obviously not fair to lay the blame on the ill-treated and over economized gas. It is all a matter of cost; and if the people of London will pay for a good light they can have it through the familiar agency of the condemned lamp-post.
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> This is the argument of the gas engineers; and to the Phœnix Gas Company belongs the credit of submitting its soundness to the test of public experiment. By arrangement with the Lambeth Vestry, a section of Waterloo Road was on Saturday night lighted on improved principles; and the popular verdict, as far as it might be gathered from the freely-expressed opinion of the crowd attracted by the unwonted illumination, was that the experiment was a success. The "improved" principle was mainly based upon the simple expedient of burning more gas in order to get a better light. But this end was furthered by all that sedulous care, high skill, and long experience could suggest. The section of the road experimented upon extends from Waterloo Bridge to the Railway Station—a distance of 500 yards. Hitherto 22 gas-lamps, including a feeble galaxy of six at the York Road crossing, have dimly lighted the thoroughfare.
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> Under the direction of Mr. Corbet Woodall, the accomplished Engineer to the Phœnix Gas Company, with whom the experiments originated, these lamp-posts were removed, and 48 new ones set up—of course, at closer distances. The new lamp-posts differ from the old ones in many important particulars. In the first place, they are 2 feet shorter—a hopeful recognition on the part of gas companies that it is the street pavement that wants lighting, not the first-floor rooms of the adjacent premises. The lanterns are crowned with opal glass,* which reflects downward a greatly increased proportion of the light. Moreover, the iron framework in which for many generations the lantern has been set is done away with; and with it vanish the black shadows cast on the pavement, which have made the space at the foot of the lamp-post the darkest in the street. Finally, the supply of gas is increased, though not materially—the new burners giving a supply of 15 candles as against 12 candles, the former maximum. The effect of the alteration may perhaps be best conveyed by the statement of the simple fact that, standing in the middle of the road just below the bridge, where no assistance is derived from shop lights, it is possible at seven o'clock to read a newspaper.
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> This illumination, brilliant as it appears by comparison with the ordinary lighting of the bridge, or in any of the streets which bisect the roads, pales before the still greater things accomplished at the York Road crossing. Here single lamps stand in the two "sanctuaries" in the middle of the road. In respect of mere ornament, these lanterns are most grateful to the eye; and the vision which rises up in the excited imagination of the streets of London dotted with them in place of the forbidding posts that rise out of the ground at intervals down the long, unlovely street is very pleasant.
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> In the meantime, the experiments have supplied an interesting and valuable contribution to a controversy in which the public take the keenest interest. What they want is good and sufficient light, furnished at a moderate cost for houses and streets, and they will be thankful if either the gas companies or the promoters of the electric light will supply them with it.
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> The retort courteous of the Phœnix Gas Company to the brilliant arguments of the electric light seems to prove that the gas companies can light the streets if the public will consent to pay for the luxury.

In the article are many figures and tables giving comparisons between the cost of the two illuminants in such a thoroughfare as Waterloo Road, which are greatly to the advantage of the gas lighting. All this in an impartial daily paper! Now history repeats itself, in this case by the same individual, who, after 33 years, is still spared to us; and the victory he achieved in the seventies with the flat-flame burner against the open type of arc lamp, he is following up by continued victories with the high-

* This was the first time that opalescent glass was used in the roofs of gas lanterns.

pressure gas-lamp against the newest form of flame arc, and with the low-pressure inverted gas-burner against the metallic filament lamp, as witness the lighting of Regent Street, Whitehall, and Victoria Street, also the side thoroughfares, not only of Westminster, but all over the Northern Metropolis. We have not hitherto heard nor read anything of the early experiments and victories of Mr. Corbet Woodall in the far too scanty remarks on his brilliant career; but the well-known modesty of the Governor of the Gaslight and Coke Company may account largely for this. The industry is, however, discovering him afresh.

AN ADDRESS BY MR. W. DOIG GIBB.

[Delivered at a Meeting of the London and Southern District Junior Gas Association on Oct. 25.]

For such an address as may be expected from me to-night, it is not possible to find a new subject. Nor do I desire to fall back on the old monotonous *résumé* of works practice, and tread the worn path from retort-house to gasholder. I would rather try and say something which might come under the familiar poster-heading of "A Straight Talk with Young Men." But at once a difficulty crops up, because your Association, though called a junior one, embraces within its ranks not only the young men just starting on what I hope will be prosperous careers, but many others with lengthened experience and considerable knowledge. If my remarks are elementary, the latter will forgive me; for, after all, they are better served by their experience and by the Technical Press than the younger members, who are as yet students with a limited knowledge.

The copy of your "Transactions," which I have recently received, is formidable evidence of the excellent work which the Association is doing, and proves beyond question what I have never doubted—that Junior Associations are of considerable value, and are, in fact, necessary. There is one phase of them that I do not think has ever been mentioned. A man is a better man if he can speak in public, and say in plain language what he means to say. An Association such as yours is a good training ground for this. I do not mean that we can be all orators; for those are born and not made. But, apart from this small gifted class, it is a great benefit to any man to be able to speak intelligently when the spirit moves him, or when he is called upon to do so. In your future "Transactions" I would, therefore, like to see the names of all your members figuring in other parts of the volumes as well as in the lists of members. I need not quote cases where a cool demeanour and being able to say what one wants to say is of value. I need only suggest an appearance before directors of a person on a short list. Nor should we despise the short, nervous speeches of the youngsters, but rather, by our sympathy and encouragement, help them on to better things.

It is generally known that I am a strong believer that the best man is usually found to be one who has had a judicious mixture of practical and theoretical training. But we are often the victims of circumstances; and what one has and what one would like to have are two very different things. It is, however, far easier nowadays to make up leeway; for there are a multitude of technical classes and books and Associations, such as yours, to help on towards the ideal.

Mr. Browne, in his address to you last year, made some very excellent references to examinations. Continued and careful study is the principal thing; and though creditable passes in examinations are very desirable, they are far from being everything. Arrange examinations how you will, they cannot cover nearly all the parts of the wide subjects studied, and luck has too great a place in them. Mr. Browne rightly said examinations should be subordinate to the teaching; and he also said that it had been decided, in regard more especially to certain classes of Technical Institution students, to leave the examination and issue of diplomas to the teachers concerned. As to the wisdom of this, I have my doubts. I think that if I were a teacher, and had to set papers, I could arrange for a large percentage of passes—a state of things very dear to the heart of every teacher. Again, if different teachers were to set different examination papers on the same subject, the great value of the diploma which might be gained would be lost, because it would not represent merit over a large number of students, but only over the fellow students in some particular class. I am afraid examinations will always be in the nature of a lottery. No doubt the student who is well up in all the branches of his subject will pass, but may be bracketed with much inferior students who have had luck in the questions. And in this bustling age of telephones, telegraphs, shorthand, and typewriting, we cannot now revert to the Chinese method of national examinations which last for some weeks on end. Nor would the British nerves stand such an ordeal. For my own part, I much prefer to look into a man's training and opportunities for learning, and judge him on these.

An increasingly common plan, for junior positions at least, is to take a man on trial for (say) three months. It is often pointed out that this may mean a great hardship if the man does not suit, and has given up a position to go on his trial. But I think it is a fair bargain; and if a man has the knowledge that he is trained and fit for the position, he has little to fear. The only ones to suffer are those who have not made the most of their opportunities, but are determined at all costs to "get on." But, in these present days, an unprepared man cannot hope to get far. It is unfortunate that good billets are not always found by those who are prepared; but the preparation must be done if a possible opportunity is to be seized and made the most of. It may well be asked, "What is the preparation required?" This is a question more easily asked than answered. All studious work is preparation, sometimes direct, sometimes indirect. But for young men, with all the temptations of a pleasure-seeking world round them, I would say strenuousness. The old scriptural adage has a lot of truth in it—that whatever your hand finds to do, do it with all your might. This applies all through; and a young man is not making the most of his opportunities if he ever does anything in a way that he knows he could improve upon, and is content with the slovenly remark that "it will pass."

Now in regard to this I think that employers are often to blame. No doubt overtime is sometimes necessary and will be cheerfully done by all right-thinking men; but continued overtime, through being understaffed or from other preventable causes, has only one result, and that is, to get less work and less accurate work from the overworked employees. The best man to my mind is the one who works hard while at work, has recreations and hobbies, and who so keeps in proper training a sound body and a clear head. This is the man who will help his company and help his fellow-workers.

It is a vexed question whether a man's future prospects are better with an all-round gas-works training or with a specialized one. Specialists, it must be remembered, can only be afforded by large undertakings; and the openings, in consequence, are fewer. This being so, I sometimes wonder if they are paid in proper proportion to others. They have entered a narrower path, they know more of their subject than an all-round man can hope to do, and yet are they always recompensed as they deserve? Perhaps this applies to many younger men who are not specialists, but who have studied and worked; for I am bound to say that if one looks at what is often the small difference between labourers' pay and what such men are receiving, it would appear that brains and training are sometimes considered of very small value.

I notice with great satisfaction that your programme includes numerous visits to works, &c. This is as it should be; for it enables you to see what others are doing, and absorb for your own benefit all that strikes you as good. How often does it happen that a stay-at-home man has an idea which is eventually found to have been thought-out by others years before. There is ample opportunity for you all to make a name for yourselves, for many problems are still unsolved.

It is now generally conceded that a low sulphur content in the finished gas is desirable. At present, this means the use of lime as the purifying agent, with all its attendant nuisances and uncertainties. A low sulphur content with oxide only as the purifying agent would appear to be a most desirable thing if it can be done, and done at a low extra cost. It will not be long before such a process is available; but the person responsible for the process rightly desires that it should be tested and re-tested on a large working scale before it is made public.

There always remains that elusive substance naphthalene for study and research. I would fain see a process which would result in keeping it in the gas, and getting the benefit of it; but efforts in this direction do not seem to have resulted in a universal remedy. If it cannot be held, then the next best thing is to get hold of it at the most convenient point and in the most convenient way; and there are many workers seeking this desirable end.

Another problem which might well take up your attention is the question of greatly increasing the yield of ammonia recovered per ton of coal carbonized. This appears to be a great possibility; and we know enough of the monetary value of the product to be sure that the discovery of such a process would mean wealth and honour to the fortunate discoverer.

Our old friend "carbonizing" is still a foremost question. I am not certain that the last word has been said about horizontal retorts. No doubt heavy charges are now believed in; but it is questionable whether the best proportions of weight of coal and time for carbonizing have yet been determined with any exactness. If it should be proved that filled retorts are not the best, horizontals may have a new lease of life. No doubt the effects of the travel of the gas through horizontals and verticals will also have to be studied; but verticals must be full, horizontals need not be.

Many engineers at the present time are grateful to water gas for seeing them through their recent troubles; and the process has many claims on our considerations. The most important of these are the small ground space occupied, less initial capital outlay, rapidity with which gas can be produced, and the use of a by-product when coal is scarce. To my mind, the days when such a plant can be looked upon solely as a stand-by (in other words, for intermittent working) have passed away. If the units are properly proportioned, and the mixing of coal gas and water gas be correctly done, then such a plant may be all right. But present-day conditions call for a uniform gas from day to day; and a varying mixture of coal gas and water gas cannot be in the best interests of the consumers. For this, you would require constant adjustments of burners to get good results; and the general public will not be bothered to make these, even when they know how to—which is not always. The alternative in these days of competition is no alternative at all—to have your burners of such a rough-and-ready kind as to burn any gas, and give any efficiency, an efficiency which at best must always be below that of burners properly designed and using a uniform gas.

If a gas of regular quality be now required, it follows, as a natural sequence, that a regular pressure is also desirable. With gas-mains of any length, and in the absence of house governors, this is not possible unless to some extent at the extreme ends of the mains. No doubt there are burners on the market which give a nearly equal efficiency within certain ranges of pressure; but in spite of this an equal and sufficient pressure, day and night, is most desirable. From the congested nature of the streets, and the consequent difficulties in laying new mains, it is likely that the range of pressure between the beginning and the end of mains will tend to increase rather than to diminish. The remedy would appear to be to govern each supply; and before many years are over, I expect to see governors installed as necessary adjuncts to meters. This will involve large expense. Your members might well take up this governor question. What to my mind is required is, of course, a strong, reliable, and, above all, a cheap governor. The apparatus should also have a mercury seal in preference to a diaphragm, and have such a range as would make it safe when up against considerably higher pressures than are at present used. It should have a flat base, so that the mercury would stay in its proper place when the governor was stored, and also be so designed that, if accidentally tipped, the mercury would return to its cup when the governor was put into its proper position again, and not get into wrong places, and so be a possible trouble and make a doubt as to what seal the apparatus had. The metal used should not be acted upon (or at least as little as possible) by mercury or gas, the design of the valves should ensure a minimum risk of leakage at the seats through naphthalene or dust, the whole apparatus should be capable of being readily taken to pieces, and all parts be capable of only going into their right positions when put together again. And, once more, the governor must be cheap.

Another thing which might have your attention is the standardizing of gas cookers and fires. In most large undertakings, it is little short of appalling to go round the stores and see the vast numbers of parts which require to be stocked in order to quickly remedy defects. It would appear unnecessary to have so many varieties—varieties, too, which do not differ greatly in their efficiencies. As the Americans say—it is a considerable proposition; but it should not be an impossible task if makers and buyers were united on the subject. It would enable canvassers to have an easier task, stock would be much cut down, and cheaper goods would be possible.

I had almost decided to stop here and let this important subject be the last word; but the recent labour unrest is worth passing notice. I have nothing but praise to give to our 6000 men, for through it all they worked loyally and well. It has impressed me greatly that co-partnership should be of such great power and benefit to employer and employee alike; and the longer I remain in the South, the more convinced I am that it is a great power for good, and would appear to be the only solution of the labour question.

In conclusion, let me, for a moment, turn once more to the younger men. Probably the most difficult problem which they may be called upon to solve is the proper management of workmen. The days are gone when men can be driven. Education and knowledge of power have changed all this. It is well that it is so; for we all have only one life to live, and we all have our feelings. This question of labour, as many another, should be approached with a determination to be fair, to be considerate, and to be courteous. Have these as your aims and act up to them, and it is possible to get good work, and willing work, from those who are under you, and to make life pleasant for yourselves and all who come in contact with you.

I wish your Association every success, and I hope you may be as fortunate in your future officials as you have been in the past; for the Association is strong and full of vigour, and is a credit to those who have controlled its destiny.

Some Remarks on the Address.

The PRESIDENT (Mr. D. J. Winslow, of Lea Bridge) remarked that they had had an exceedingly interesting address, and the matters touched upon could easily form the subject of a long discussion. Last year, when the Association went to the Old Kent Road Works, they had the privilege of meeting Mr. Doig Gibb; and he then promised that he would soon come and give them an address. There were a number of distinguished patrons present; and he was sure the members would be pleased to hear something from them. He then called upon the following gentlemen to make some remarks.

Mr. F. W. GOODENOUGH said it was a thankless task to follow as the first speaker after such an able and instructive address as that they had just listened to. A more virile and thought-compelling address than the one Mr. Doig Gibb had given them, it would be difficult to imagine. He (Mr. Goodenough) felt that he would only be disturbing in the minds of the members the thoughts which the address had raised, if he were to inflict upon them any lengthy remarks. It was always a very great pleasure to meet Mr. Doig Gibb; and it was a still greater pleasure when he took the opportunity of opening his mind and letting his hearers know what he was thinking about. He had touched upon many topics of great interest; and on some future occasions the members might very well make the points he had dealt with the subject of discussion. They could easily occupy three evenings in this way—if they started early. He was very glad to hear the reference to the question of labour unrest, and Mr. Doig Gibb's allusion to the value of co-partnership in the recent crisis in the labour world—a crisis which had by no means passed away, though perhaps its outward symptoms were not now so violent as a short time ago. As he had said, the advance of education and the increased knowledge of social and political power of the workman, had made it certain that the labour question would occupy a very great deal of attention in years to come. He (the speaker) could certainly say from his knowledge of co-partnership—and his experience of this admirable system was not so lengthy as that of their friends across the water—that, though, of course, it might not be the ultimate solution, so far as they could possibly see at the present moment it was the very best solution that had been found for the problems in connection with the relations between Capital and Labour.

Mr. F. W. CROSS remarked that this was the first time he had had the pleasure of being present at a meeting of the Association, but he trusted it would not be the last. He quite endorsed what Mr. Goodenough had said as to the value of the address, which bristled with subjects that would give one thought. Personally, he was very much struck with the remarks on the education of the juniors, and their struggles for examination honours—having been through it himself in his younger days. He could quite bear out what Mr. Doig Gibb had said—that an examination was quite a lottery; but, at the same time, it was an incentive to a young man to carry on the study of the subject he took up. He remembered—and he supposed the same thing applied at the present time—when starting the winter session at the end of September, the classes were full in numbers; and they continued full until about Christmas time. Then there came a falling-off of the students who had no "go" in them; and it was those who continued after Christmas who were the coming men. They went on with the examination in view. It was an incentive to them to push on; and, by getting to this stage, they obtained knowledge. And not only did they obtain knowledge, but they were establishing force of character in themselves which would help them in the future. It had often struck him—and he had mentioned it on several occasions to brother engineers—that it would be a great benefit in connection with the education of gas engineers if the articled pupils and apprentices on a works could be, by mutual arrangement, transferred from one works to another—that was to say, change places with each other. Of course, this was a big subject; but he thought it would be greatly to the benefit of the young men, if properly worked out, and also greatly to the benefit of the industry in the future. A man trained on one works became imbued with the mannerisms, if he might say so, and the peculiarities of the Chief; but if he went to another works, even for only a short time, he came back with a broader mind on things in general. This was a problem that would have to be worked out; and the body to work it out would, he thought, be the Institution of Civil Engineers, who would have the education of the young men in view. Mr. Doig Gibb had touched upon various points in connection with works practice. In the matter of retorts, he said finality had not been reached. He (Mr. Cross) quite agreed that finality was yet far off. As many of those present knew, at Lea Bridge they had inclines; and inclines, at the time they were put in there, were in their heyday. They performed their work well; and their work at that day was to overcome the labour unrest. They were undoubtedly successful in this; but that time had passed. They had not now the agitation in gas-works that they had then; and if they could not get the results out of inclines, they must go. But at Lea Bridge they did get very good results from inclines. Of course, the great drawback to the system was the cost. The same thing applied to verticals. So that the problem was still unsolved as to which process was the best from all points of view. Mr. Doig Gibb had also alluded to naphthalene as being one of the troubles that required a solution. This, again, was a very big subject indeed. One did not care to go into it very far; but he (Mr. Cross) might perhaps just suggest to the younger men a line of thought. It might help some of them to give a little more consideration to the matter. At Lea Bridge they used all the pumpings from the mains of the water-gas plant—from the syphon of the relief holder to the purifiers—which, as they knew, contained a lot of volatile residual oily tar. This was pumped up to a tank on the top of the retort-house, and run down in small quantities into the hydraulic main. Of course, there was the heavy benzol there, and the naphthalene would be picked up in the hydraulic main. They were not troubled with naphthalene at Lea Bridge in the slightest degree so far as the works were concerned, and very little on the district. That they had any naphthalene at all was purely due to too high heats. Water gas was a useful adjunct to a gas-works; and he would to a slight extent join issue with Mr. Doig Gibb in the matter of a mixture of water-gas being detrimental if it was not carefully proportioned day by day. He (Mr. Cross) did not think the proportion of water gas need be so exact from day to day. To his mind, there was a margin up or down within which one could get just as good results. It might not be scientifically accurate; but for general purposes there was this margin. There was never any trouble on the Lea Bridge district. They had a large number of inverted outside lamps on maintenance, and found them very satisfactory. Of course, with the present system of working they could not avoid getting a slight variation in the percentage of water gas—especially where one was working on a storage capacity of about 70 per cent.

Mr. A. F. BROWNE thought that the Executive of the Association were to be heartily congratulated on their good fortune in having secured Mr. Doig Gibb to give an address at the opening of the

new session. Mr. Doig Gibb, as they all knew, was a man of wide experience. He possessed very definite opinions, and he had the happy knack of being able to state them clearly. At the same time, he was broad-minded, and in no sense a partisan; and, from one who knew him better than some of those present, members would not be surprised to hear that he was always prepared to consider a question on its merits. The address they had listened to was very encouraging to the younger members of the Association, who, no doubt, formed the majority. With regard to the remarks as to specializing, many of the audience would be pleased at the sympathetic view that Mr. Doig Gibb took of the position of the specialist in particular departments of gas-works. He (Mr. Browne) had also thought sometimes that the young men who had qualified in special directions were not always so well remunerated as the education with which they had had to be provided should have led them to expect. The address possessed a feature of very peculiar and distinct value, in the fact that Mr. Doig Gibb, out of his wide experience, suggested to the younger members of the Association more particularly certain problems upon which he thought there was still room for much good new work to be done. The subjects set forth seemed to him to be well worthy of careful consideration. The endeavour to do original work was no doubt very fascinating; and a young man might easily throw away much valuable time by, so to speak, "barking up the wrong tree." But with such a list as had been suggested before them, and with all the facilities that existed at the present time, and with the aid of one's technical friends which was always readily forthcoming, young men who wished to work need not go far wrong and waste the time which was of such value to them. One other point had appealed to him with very great force. It was characteristic of the man; but it was a point which they must all bear in mind. And it did not only refer to the working man, though it was essential that they should remember it in this connection. Mr. Doig Gibb had said that, in their dealings with those with whom they were brought in contact day by day (he instanced the workman, but included in his own mind all the employees of the numerous grades existing in the gas industry), it was necessary to be fair, considerate, and courteous. These were qualities which endeared a man to those with whom he worked; and the words were spoken to them out of the fulness of Mr. Doig Gibb's heart. He (the speaker) commended them to the members as being characteristic of the author.

Mr. F. J. Bywater said he felt he could not add much to the interesting remarks that had already been made on the address. The last words of Mr. Browne, however, exactly coincided with his own opinion. Those who had the privilege of knowing Mr. Doig Gibb knew that these were not merely trite remarks of his. They were the guiding principles of his professional conduct. The address, as Mr. Goodenough had said, bristled with suggestions and suggestive thought of all kinds; and it would be a good idea to have some of the points discussed fully. Perhaps Mr. Doig Gibb might not be unwilling to come and hear the members talk about them. There was one thing which he would like to say; and in doing so he had in mind Mr. Browne's address to the Association last year, as well as Mr. Doig Gibb's address that evening, and the papers read recently before the Institution of Gas Engineers. What he wanted to say was that the education of the young gas engineer was in an almost chaotic condition. A young man did not know what to take up except gas engineering and supply. His education did not by any means begin and end there. He had to be a civil engineer, a mechanical engineer, a good chemist, a good mechanic, and to some extent an electrical engineer. He really did not know what to take up, and there was very little to guide him. He (Mr. Bywater) recently came across an excellent little book prepared, he thought, by Mr. Stokes, of the South Metropolitan Gas Company, as a guide to the young men of the Company in the matter of the classes they should take up. This was very good in its way; but he would like to see the London and Southern Junior Association taking up the question of the education of the young gas engineer, and if necessary approaching the Institution of Gas Engineers, to place on record the opinions of the leading engineers of the industry, who were only too happy to give of their vast experience to guide the younger members. There was any amount of work to be done, and it could only be done by thoroughly skilled technical men who had had a proper system of education from the beginning. They should not allow this question of education to stay where it was. It required putting on a proper footing, and young men wanted guiding in a way which would enable them to look to the future with a certain amount of satisfaction. They wanted the leaders of the profession to give their ideas and suggestions as to which way their education should go. Though examinations were not the end of all things, they did help to show the man who had a job to give whether an applicant had been lazing and slacking about or really trying to improve himself.

Mr. Cross suggested, as following upon Mr. Bywater's remarks, that, if particulars were obtained from the members of the Association regarding the classes that they had taken for some few years, and these particulars were brought together and analyzed, it would be of great assistance to the Council, and might enable them to formulate some plan themselves.

Mr. J. G. Clark, in proposing a hearty vote of thanks to Mr. Doig Gibb for his excellent address, said that some remarks in the early part rather reminded him of something that occurred in his own experience a little time ago. During conversation, the talk turned upon work and play, and a doctor present said that work was play, and play was work. This seemed to him a very good idea; and the sooner they could look upon work as play, the better it would be for them. Mr. Cross had mentioned classes, and a falling off in the attendance. He (Mr. Clark) was pleased to say that so far as he was acquainted with the classes at the Westminster Technical Institute, the attendance did not fall off in any very great degree. Last year in a particular class on gas supply, with about 40 names on the register, the average attendance, he thought, during the whole of the session from September to May was between 33 and 35.

Mr. W. J. Liberty seconded, and remarked that the Association had had the honour of being addressed by most of the prominent men connected with the gas industry of the Metropolis and its neighbourhood, and they were all delighted to have Mr. Doig Gibb's name added to the number. The South Metropolitan Gas Company, of which Mr. Doig Gibb was the Chief Engineer, had always been a go-ahead undertaking, and was one of the first to discover that dividends were not made altogether in the retort-house.

The vote was carried with loud applause.

Mr. Doig Gibb, in acknowledgment, said he thanked them all for the cordial reception they had given him, and the speakers for their kind remarks. He came to the meeting with very serious doubts as to whether the address was appropriate; but it had been so well received that he would not be afraid to come again at some future date, if they would be good enough to ask him.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Opening Meeting for the Session.

The Annual Meeting with which the Yorkshire Junior Gas Association is wont to open its new session was held last Saturday in the lecture theatre of the Bradford Technical College. The retiring President, Mr. C. D. Cawthra, was unfortunately confined to his house by illness; and the chair was at first occupied by Mr. C. T. B. Roper, the Junior Vice-President. The usual formal business was transacted. The Council's report for the past session evidenced good solid work done at the monthly meetings and visits; and the financial statement was equally satisfactory. Both were approved, and the retiring officials thanked for their services.

A message of sympathy was sent to Mr. Cawthra, regretting his absence, and its cause; and a resolution was passed congratulating Mr. R. Halkett on his appointment to the newly constituted post of Commercial Superintendent to the Glasgow Gas Committee. Mr. Halkett's many services to the Association were gratefully alluded to by several speakers; and the warmest good wishes were expressed for his success in the new post, for the occupancy of which his exceptional fitness was emphasized.

The new President—Mr. W. Walker Atley, of Whitwood—was then installed, and expressed his thanks for the honour conferred upon him. Describing himself as one of the youngest members yet called to the official headship of the Association, he promised to put forth his best efforts in maintaining its success and promoting its interests.

The election of officers for the ensuing session was then proceeded with, and resulted as follows:

President.—Mr. W. W. Atley, of Whitwood.
Vice-Presidents.—Mr. C. T. B. Roper, of Bradford; Mr. J. W. Lee, of Chesterfield.
Treasurer.—Mr. C. H. Turner, of Mirfield.
Secretary.—Mr. E. Garsed, of Kippax.
Council.—Mr. C. D. Cawthra, of Halifax (*ex-officio*); Mr. A. Edwards, of Leeds; Mr. E. Gillett, of Bradford; Mr. J. H. Hill, of York; Mr. P. M'Nab, of Low Moor; and Mr. C. V. Townsend, of Wakefield.

Arrangements for the session's programme were announced; but the dates and some other details of several visits were not quite definitely settled.

A cordial vote of thanks to the authorities of the Bradford Technical College for their kindness in granting the use of their rooms on this as on so many past occasions terminated the business portion of the meeting.

A discussion on "Coal Storage and Fires in Stored Coal" was then entered upon. This was to have been opened by the ex-President (Mr. Cawthra); but in his enforced absence, Mr. W. Cranfield took his place. An animated and interesting discussion followed; and the meeting did not close till a somewhat late hour. The subject had been chosen as being of special interest and importance at this juncture; but it was also thought to be one on which the speeches at a Junior Association meeting were best not published. The proceedings were conducted accordingly "in committee." It was remarkable how that, with few exceptions, the speakers (several of whom were able to speak of long experience) declared that they had never had any fires in the coal-stores on their works. The precautions taken to avoid such fires were described; and the results to the coal of long storage, as revealed during the recent coal strike, were given.

COLOUR EFFECTS OF ILLUMINATION, GAS BOOSTING, AND INVERTED LIGHTING.

By D. J. Winslow, of Lea Bridge.

[Presidential Address to the London and Southern District Junior Gas Association, Oct. 25.]

When one is asked to give an address, the first difficulty that arises is the selection of a suitable subject. I may say that this difficulty presented itself to me, as one naturally is anxious to avoid well-trodden paths as far as possible in such a progressive industry. It occurred to me that a description of the gas-boosting plant erected at Lea Bridge might not be altogether unacceptable to our members, preceded by some notes on colour phenomena in its relation to the incandescent gas-mantle, and then an idea in inverted burners.

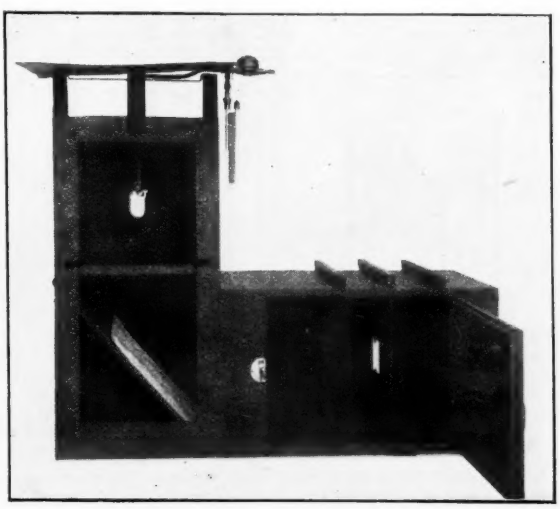
COLOUR EFFECTS OF ILLUMINATION & COEFFICIENTS OF REFLECTION.

The colour question as regards the incandescent gas mantle is, to my mind, of great importance to the industry, and our business could be considerably increased if we had at our disposal an easy and ready means of adaptation when required. The following are some notes on experiments I have made this summer in connection with colour effects of illumination by gas and electricity, together with coefficients of reflection obtained by screened and unscreened lighting on various tinted papers, and with an endeavour to arrive at the colour composition of the illuminants used.

We are all very well acquainted with the usual parade of shop lighting, with its ever-varying changes of forms of lamps, and especially the great variety of the colours given by the light sources. I do not for one moment suggest that we should endeavour to obtain a monotonous uniformity in this direction; but there appears to be a great field here for good work. We all know how impossible it is to attempt to do any colour matching by artificial light, and the further difficulty of choosing a fabric by daylight which will be required for evening wear—the buyer of the article not knowing how it will appear under the various artificial lights which are likely to be in use. This also applies to internal house decorations. The artists and designers of tapestries, carpets, linoleums, furniture coverings, &c., with various shades of reds, blues, and greens, undoubtedly (working with ordinary daylight) find a vast difference in the colour effect with various artificial lights. There appears to be good work to be done by the gas-lighting expert in devising the kind of light required for any particular purpose, or, if necessary, endeavouring to produce a source of illumination as near daylight as possible. Mentioning even an everyday instance of shop illumination, take the usual butcher's. Undoubtedly meat of all kinds, both good and indifferent, is seen at its best advantage to the prospective buyer under a good yellow-red light—such as the old gas flat-flames or the carbon filament electric lamps. The same coloured light generally suits fishmongers; the red and yellow colours are, of course, lightened considerably and changed in tone. The draper prefers a light as white as possible to do justice to his coloured goods, although one often sees the yellow flare arc lamp outside these establishments, and wonders where is their attractive power to the buyer, or even for that matter to the goods displayed.

This subject appears rather vague to the average layman; and the lighting expert, when called in, has generally some difficulty in advancing its claims to his customer, and showing that light falling upon walls and ceilings which have poor reflective capacities or coefficients, is absolutely lost and is money thrown away. On the other hand, we have the system of lighting which depends mostly (if not entirely) upon the reflective capacity of the walls and ceilings, as in some institutes, banks, large city offices, and mission churches, with the usual upright burners on pendants, having underneath a large deep obscured bowl, and the top half-open to the higher wall area and ceiling, by which about three-quarters of the light on the working plane is derived from the cross reflections of the walls and ceilings. This light varies, of course, with the degree of cleanliness of the walls and ceilings; they being generally painted white. I know of a mission church which was formerly lighted in this way, and which had been built for some years. The time came to consider the redecoration of the interior. The inside of the roof was stained a dark walnut, and the walls were painted a medium green. After this, there were complaints of insufficient lighting; and they were advised to obtain more direct light by taking away the large obscured bowls and adopting suitable globes or shades.

I do not think there are many who would advise a system of lighting by reflection only, because of the very high cost compared with direct lighting; but there appears to be no reason why we should not endeavour to utilize as far as possible the reflective power or capacity of walls and ceilings. To obtain the maximum amount, the decoration on walls should have as high a reflection coefficient as possible; and this again would materially assist us in our lighting costs. We must be careful not to have a monotonous uniformity, and to arrange to have the necessary coloured surfaces where they can be seen without affecting, if possible, the lighting efficiency. When, however, one thinks of reflection and the complications that arise owing to the numerous cross reflections from and to the walls and ceiling of a room, it is very puzzling; and I should have liked to have continued the experiment further, and endeavoured to obtain an approximate value for the total flux of light on a working surface due directly to the reflecting capacities of the samples of paper under test, and screening-off the direct light from the source. I would suggest that there is a good field here for experimental work, whereby an approximate relation could be obtained between the coefficient reflection of a paper and the total flux of light to be expected from a given area when the polar distribution curve of the source is known. Perhaps if this were accomplished, even then the existing conditions would present a formidable aspect for comparisons. A good number of wall-papers in ordinary use have various colours and gradations of those colours and patterns which render it a difficult matter to obtain a coefficient of reflection by merely comparing directly (say) with the standard test-card of the "Holophane Lumeter," as the various light and dark tints would give different readings.



Box for Reflection Coefficients.

Therefore the box used in the following tests was designed to collect the average reflections from a square foot of the paper, which in a general way is large enough to obtain a fairly representative portion, and the paper was exposed to the light at an angle of 45°, and readings taken vertically on the standard surface. The box was coated inside with a very dull vegetable black, to obviate the risk of error as much as possible, and the source of light was carefully screened so that no direct light could reach the standard test surface. The gas-burner used was one of the Graetzin type, with a single-ply Graetzin mantle. The burner was regulated to give the best apparent results with a gas consumption by meter of 4 cubic feet per hour; and between the meter and burner two governors were fitted to maintain a constant pressure, together with a pressure-gauge to ensure that the lighting value of the mantle should remain the same during the operations. The centre of the mantle was 14¼ inches from the paper under test.

As an electric supply was available, it was considered that it might be of some use to take a series of tests with a metallic filament lamp, and note and compare the results against the inverted gas-mantle. It was not intended to make any invidious comparison, but merely to trace any difference that might exist in the relative lighting values. The electric lamp employed was one taking 205 volts and 200 watts (and had been in use between 400 and 500 hours), with the lower half of the bulb obscured. The normal position of the lamp was vertical; but for the purpose of this experiment it was used horizontally (so that the greatest length of filament was presented to the area of paper), and with the centre of the horizontal filaments at a distance of 14¼ inches from the various papers under test.

The values obtained from the electric lamp are direct readings; but those from the inverted gas-burner have been brought up so that the common basis represented by the value given from the white blotting-paper should be identical. Hence the values given are all relative ones, as there was no occasion to standardize the "Holophane Lumeter" for each series of tests; the only proviso necessary being to see that the value as given by the white blotting-paper remained constant throughout for both electricity and gas. It was found that identical results were obtained from a sheet of opal glass of 1 square foot area; and this was used for comparison against the blotting-paper.

The "Holophane Lumeter," invented by Messrs. Dowe and Mackinney, was used for the readings on the test chart; and no doubt you are all well acquainted with it. I consider this lumeter a very useful and reliable apparatus; and it should be readily accessible to every man who may be called upon to deal with lighting installations. Its uses are numerous; and an advantage is that it can so easily be standardized by the usual 10-candle

pentane lamp, which is done before and after every experiment to ensure its accuracy, though it is surprising to find the exceedingly small variation (if any) of the scale, provided the accumulator has been properly charged. With reference to this lumeter, it may be well to mention that it can be usefully applied in taking an illumination curve of any lamp or burner; the only addition necessary being to have a suitable "long-arm," with the various angles easily secured, and the test chart arranged normal to the direction of light. We then have a reading in foot-candles; and this figure multiplied by the (distance)^2 gives illuminating power. Another good feature of the instrument is the ease with which it can be operated. Any layman who is interested can at once compare the lighting values of different sources of light without any previous experience. This is most useful for comparisons of rival illuminants, and also for seeing the effects of various kinds of reflectors and shades. In billiard-table lighting it can be used to great advantage. It is really surprising to notice the great differences that exist in the lighting of the tables in use at the present time—pointing to the wonderful accommodating power of the eyesight in its easy adaption to almost all conditions.

The papers chosen for test were ordinary wall-papers taken from a wall-paper album as used by house decorators; and the values of their respective colours are given later on in terms of Lovibond standards.

TABLE I.

—	Blotting.	Red.		Blue.		Green.		Extra Blues.		Total from Coloured Papers.
								Dark.	Light.	
		1.	2.	3.	4.	5.	6.	7.	8.	
E. L. .	3·6	1·0	1·0	·9	1·0	1·0	·73	1·0	2·2	8·83
Gas . .	3·6	1·2	1·32	1·16	1·2	1·32	·90	1·32	2·8	11·22

Table No. I gives direct readings taken with no obstruction whatever between the light source and the various papers. The blotting-paper surface gave a reflection of 3·6 foot-candles to the test standard, and the coloured papers the values shown. It is striking to notice the almost uniformity of the values of the various papers, excepting the light blue (No. 8), which is easily seen to be of a much lighter tint than the others, and the green (No. 6), which, on the contrary, is of a dark tint and gave the lowest reading. An interesting feature of the result is the general slightly higher values obtained from the inverted gas-burner. It is difficult to give a reason for this, unless it is due to the better distributive disposition of the gas-mantle against the electric filaments. The total readings from the coloured papers give 8·83 foot-candles with electric light, and 11·22 foot-candles with gas.

TABLE II.

	Blotting as	Red.		Blue.		Green.		Extra Blues.	
								Dark.	Light.
		1.	2.	3.	4.	5.	6.	7.	8.
E. L. .	100	27·7	27·7	25	27·7	27·7	20·0	27·7	61·0
Gas .	100	33·0	36·6	32	33·0	36·6	25·0	36·6	77·7

Table No. II. gives the coefficients of reflection calculated on the value given from white blotting as 100. Coloured sheets of glass of even intensity, as far as practicable, and 1 foot square, were selected; being one each of red, blue, and green. Their respective intensities are given later on in terms of the Lovibond standard.

These, in turn, were placed between the light source and paper; and the results are shown in Table III.

TABLE III.

Coloured Screens.		Blotting.	Red.		Blue.		Green.		Extra Blues.		Total E. L.	Total Gas.
									Dark.	Light.		
			1.	2.	3.	4.	5.	6.	7.	8.		
Red	E. L. .	·42	·32	·3	·093	·076	·12	·056	·1	·24	1·305	..
	Gas .	·34	·168	·2	·06	·06	·07	·036	·07	·2	..	·864
Blue	E. L. .	·18	·032	·03	·046	·043	·042	·028	·041	·087	·349	..
	Gas .	·22	·05	·056	·08	·08	·076	·064	·096	·164	..	·676
Green	E. L. .	·7	·127	·127	·19	·21	·22	·17	·21	·44	1·694	..
	Gas .	·8	·134	·148	·24	·28	·32	·2	·30	·56	..	2·182

With the red screen we have greater values given all through by the electric lamp, which indicates that the electric predominates in the red rays. It is at once seen, as might have been expected, that the red papers Nos. 1 and 2 give by far the greatest coefficients of reflection, which is easily discerned in Table IV. of the reflection coefficients with the coloured glasses. The very light paper (No. 8) comes next. This fact, where colour schemes are required, points to the necessity of suiting the colour tints of globes and shades, &c., to their surroundings.

TABLE IV.—*Coefficients of Reflection with Red, Blue, and Green Screens.*

Coloured Screens.		Blotting as 100	Red.		Blue.		Green.		Extra Blues.	
									Dark.	Light
			1.	2.	3.	4.	5.	6.	7.	8.
Red	E. L. . .	100	76	71	22	18	28·5	13·0	24	57
	Gas . .	100	49·4	59	18	18	20·6	11·0	21	59
Blue	E. L. . .	100	17 8	16·7	25·5	23·9	23·3	15·5	22·8	48·3
	Gas . .	100	27·3	25	36	36	34·5	29	44	75
Green	E. L. . .	100	18	18	27	30	31	24	30	63
	Gas . .	100	16·7	18·5	30	35	40	25	38	70

The total of values given with the red glass is 1·305 for electric light, and 0·864 for gas.

The blue screen gave entirely different readings; but for the present these must only be taken as relative in comparison with the electric with the same screen, and not in relation to the red and green screens, as it will be shown that the relative densities of colour of these glasses are not identical when compared by the Lovibond standard. The values given by the blue screen are greater with gas than with electric light, indicating that the gas-mantle is richer in the blue rays; and the best results are given from the blue papers. Total readings: 0·349 with electric light, and 0·676 with gas.

The green screen gave also an advantage to the gas-mantle in the readings, showing a slight excess of green light compared with electric light, and giving a further set of coefficient reflections. Total readings of electric light, 1·694; and gas, 2·182. Most of the colours of the papers were completely altered by the coloured screens, excepting where the colour of the glass agreed with the colour of the paper; but in other cases the colours were more or less degraded.

As already mentioned, the glasses and papers were afterwards compared with the Lovibond standard, to obtain a relative value of their colours and intensities. It would take up too much time to go fully into Lovibond's theory of colour phenomena; but I have taken the following notes from the introduction to his book.

Investigators and colour workers have long felt the want of a power of recovering a given colour sensation, and of a colour nomenclature by which that sensation may be quantitatively described; for although the colour of a specific substance is constant under a given set of conditions, there is no recognized scale in which the sensation finds a position, nor can colour departures from it be described in other than general terms. The work consists of:

1—The construction of a series of glass standard colour scales, which are co-related to some physical colour constants, and by means of which a colour sensation can be measured, recorded, and reproduced at will.

2—An optical instrument and apparatus for cutting off disturbing side-lights and providing a set of normal conditions for making colour comparisons.

3—A system of colour development, colour nomenclature, and colour notation, capable of describing a colour sensation in quantitative terms.

4—A series of charts in one or another of which any measured colour sensation finds a position which no other can occupy.

5—A method of tabulating and illustrating by curves the rate of colour development for increasing densities of a given substance, providing a means for the future identification of similar substances.

6—Examples of application for scientific and industrial purposes.

7—The formation of a new colour theory and a code of laws, which have been evolved out of the experimental facts.

The test of colour equivalence is that a white light viewed through equal units of the three scales—*i.e.*, red, yellow, and blue—should give no evidence of colour. The white light used for this purpose is that of a so-called sea fog away from towns. Mr. Lovibond found that—

Red, yellow, and blue were the only colours suitable for systematic work, and also that any colour could be produced by this combination; and these three colours when once graded in equivalents were found to cover all daylight colours. Scales of red, yellow, and blue were constructed of glass slips, the slips of each scale being all of one colour, with a regular variation in intensity from 0·01 to 20 units; equal units of the three scales being in colour equivalence with each other. The dimensions of the unit are necessarily arbitrary; but the scales comply with the essentials of a scientific standard in that the divisions are equal and the unit recoverable. The quality of divisions in the scales is demonstrable by a system of cross-checking.

The coloured glasses used in this test were placed in Lovibond's "Tintometer," and matched against the standards:

Red glass was matched by 59 8 units red;
Blue „ „ 32·3 „ blue;
Green „ „ 10·0 „ yellow; 7·0 „ blue; } giving 7 units of green with 3 yellow.

It will be seen that the coloured glasses were not of the same relative intensities, but varied considerably according to the units of standard colours required to match. Hence it is necessary to bring the results to the unit standard of the relative colours; and this was done by multiplying the readings by the respective colour equivalent units. That is, those given with the red screen were

multiplied by 59·8; the blue by 32·3; the green by 17. Table V. shows the result. The percentage reflection coefficient will, of course, be the same as given in Table IV.

TABLE V.

—	Blotting Surface.	Red.		Blue.		Green.		Extra Blues.		Total.	Total.
		1.	2.	3.	4.	5.	6.	7.	8.		
Red E.L. . (Lovibond Stan. 59·8)	25	19	18	5·5	4·5	7·2	3·3	6·0	14·4	77·9	
Gas . .	20·3	10	11·9	3·6	3·6	4·2	2·1	4·2	11·5		51·5
Blue E.L.. (Lovibond Stan. 32·3)	5·8	1·0	1·0	1·5	1·4	1·4	·9	1·3	2·8	11·3	
Gas . .	7·1	1·9	1·8	2·6	2·6	2·4	2·1	3·1	5·3		21·8
Green E.L. (Lovibond Standard 17–yellow 10, blue 7)	11·9	2·1	2·1	3·2	3·6	3·7	2·9	3·6	7·5	28·7	
Gas . .	13·6	2·3	2·5	4·1	4·7	5·4	3·4	5·1	9·5		37·0
										117·9	110·3

In Table V. we see again the greater values of the readings with the red screen given by the electric light over the gas-mantle, but with the blue and green screens the advantage of gas over the electric light; the totals in the end column giving a slight advantage to the electric light, owing to the greater preponderance of the red rays.

It may be well to mention here that it is plainly seen that the coefficient reflection of any paper depends entirely upon the colour of the source of light applied to it. Normal daylight would give one set of figures, while artificial light sources would give quite different results, depending upon the colour of this source. And, moreover, daylight is a varying factor, and we have a practical difficulty in defining standard daylight, as there is a great variation in the colour and density of the atmosphere—especially in or near towns—and the variety of reflecting surfaces all round. Dr. Ives, in the "American Illuminating Engineer" for October, 1908, shows a great variation in the colour value of daylight. Taking the extreme variations we have:

	Red.		Blue.		Green.
Blue sky	100	..	120	..	106
Sunlight, 2 to 5 p.m.	100	..	56	..	91

The coefficient reflections of the coloured papers were not taken by daylight, as, of course, it would be impossible to rely on this source of light remaining constant during the whole of the experiments.

For purposes of comparison of colour, the test card as supplied with lumeter was placed on the 45° plane directly under the electric and gas units; and much greater values were obtained than from the blotting-paper surface. The following table gives these results, which have been multiplied by the respective colour intensities:—

45° Plane.

	Electric Light.		Gas.
No glass—	74	..	74
Red glass—	8·6 × 59·8 = 514	..	6·4 × 59·8 = 383
Blue glass—	3·6 × 32·3 = 116	..	4·2 × 32·3 = 135
Green glass—	15 × 17 = 255	..	16·4 × 17 = 279
Totals . . .	885	..	797

Blotting-Paper Surface.

No glass—	3·6	..	3·6
Red glass—	·42 × 59·8 = 25	..	·34 × 59·8 = 20·3
Blue glass—	·18 × 32·3 = 5·8	..	·22 × 32·3 = 7·1
Green glass—	·7 × 17 = 11·9	..	·8 × 17 = 13·6
Totals . . .	42·7	..	41·0

The colour composition of the light sources from the above figures appears as follows:—

Electric.

45° Plane.		Reflected from Blotting Surface.
Red . . .	58·1	Red . . . 58·5
Blue . . .	13·1	Blue . . . 13·6
Green. . .	28·8	Green . . 27·9
	100·0	100·0

Gas.

Red . . .	48·1	Red . . . 49·5
Blue . . .	16·9	Blue . . . 17·3
Green. . .	35·0	Green . . 33·2
	100·0	100·0

The slight variation in the values of the two surfaces may be due to the difficulty of taking readings with the lumeter when the colours are of a high intensity. Hence it would appear that the reflections from blotting-paper represent the colour values of the light units.

The colour composition of standard daylight is considered to be: Red, 33 per cent.; blue, 33 per cent.; green, 33 per cent. And if we compare the results of the test, we find the gas-mantle more nearly approaches daylight than the tungsten electric lamp. They both exceed in the red rays (electricity more so than gas), are deficient in the blue rays (electricity more so than gas); and in the green rays, electricity is deficient and gas about normal. In contrast to this, the Cooper-Hewitt mercury vapour lamp is considered to have the colour composition of—Red, 24·1 per cent. blue, 44·5 per cent.; green, 31·4 per cent.

The object of bringing this question of the colour composition of artificial light before you is to point out the advisability of serious consideration of the matter, so that we may, if possible, be in a position to control the colour of the light required, as this would undoubtedly lead to greater business. It is conceivable that the flame-temperature has an important aspect in this matter, and also the kind of burner used; and, further, the modifying effect of reflecting surfaces (secondary sources) may have a correcting influence—as, for instance, a light-source yielding radiation deficient in blue could be corrected to some extent if the reflecting surfaces were of a certain shade of blue, or we may devise special absorption screens to cover the light units. But this would be rather costly, and uneconomical in the lighting value given.

It would appear that, for our greatest help, we should look to the gas-mantle makers to assist us by producing mantles of certain and defined colour characteristics, which could be used as required in special positions, as in the electric world the carbons for the flame arcs are impregnated with certain mineral salts by which colours of deep yellow, golden yellow, or red are obtained. Why not adopt a somewhat similar process with gas mantles? Only, save us from the above colours as given by the flame-arcs.

Wall Papers Compared with Lovibond's Standards.

			Equivalent to
Red.	1.—Red . . .	11·7	Red 9·7 with orange 2·0.
	Yellow . .	2·0	
	2.—Red . . .	15·0	Red 14·0 with orange 1·0.
	Yellow . .	1·0	
Blue.	3.—Blue . .	5·0	Blue 3·0 with green 2·0.
	Yellow . .	2·0	
	4.—Dark portion—		
	Blue . .	5·0	
	Yellow .	1·2	
	Medium portion—		
	Blue . .	5·0	
	Yellow .	1·0	
	Light portion—		
	Blue . .	4·5	
	Yellow .	1·5	
Green.	5.—Yellow . .	7·0	Green 4·0 with yellow 3·0 and mutual tint on standard 0·5 each of red, blue, yellow.
	Blue . .	4·0	
	6.—Yellow . .	6·6	Green 5·4 with yellow 1.2.
	Blue . .	5·4	
Blue.	7.—Blue . .	5·0	Blue 3·7 with green 1·3.
	Yellow . .	1·3	
	8.—Blue . .	2·2	Blue 1·6 with green 0·6.
	Yellow . .	0·6	

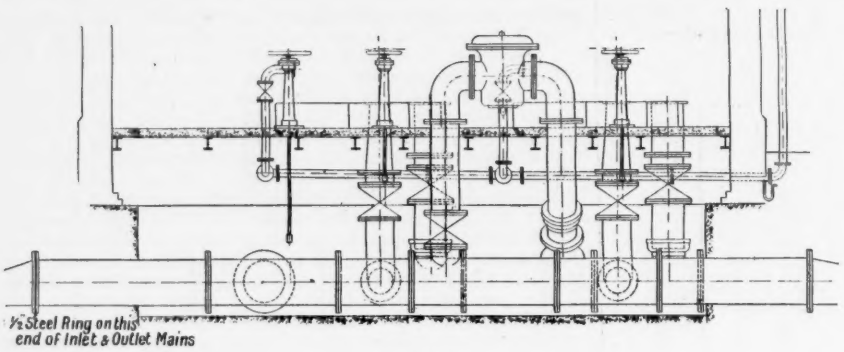
GAS-BOOSTING PLANT.

During the last few years, it has been found necessary by a number of gas undertakings to adopt some form of gas-boosting plant to suit special requirements. The following is descriptive of the small plant installed at Lea Bridge.

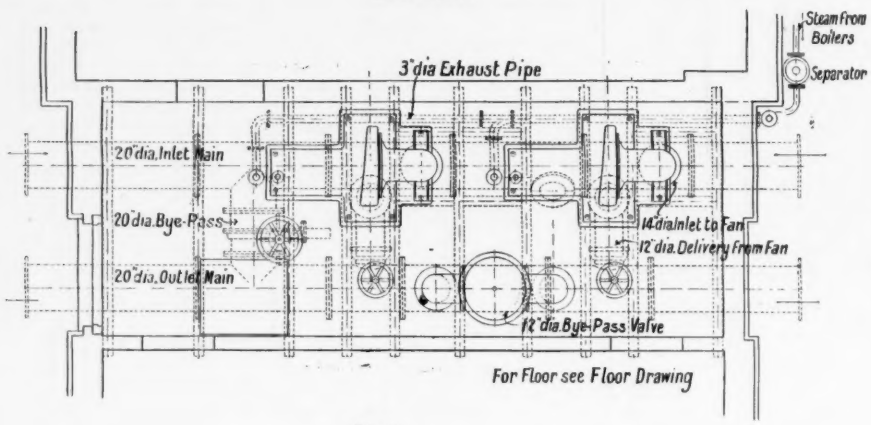
With an average yearly increase of between 7 and 8 per cent., the time came when we found it difficult to maintain a pressure of 5 inches on the outlets of the governors, which pressure was necessary to enable a sufficient service to be given at points on the district farthest from the works. Although the largest holder gives a pressure of $8\frac{3}{4}$ inches when cupped and $6\frac{1}{2}$ inches when uncupped, it is situated some considerable distance from the governors, and the pressure becomes greatly reduced by the time the governors are reached. Owing to the friction in travelling, and the great draught through the governors during the period of maximum demand, the pressure at the inlet of the governors is reduced to about $4\frac{1}{2}$ inches. The required pressure of 5 inches could not be maintained, even when the governors were bye-passed; and the trouble, of course, became greater when the stock of gas was low and the holder uncupped. This, then, restricted us to the largest holder for the periods of maximum output, and practically prevented the use of the two smaller holders during lighting hours.

We had an old photometer-room, measuring 9 ft. by 24 ft., in a long building. The coal-gas exhauster-house was on one side and the station-meter house (with district governors) on the other side; the photometer-room being between the two. It was decided to instal the boosting plant here, as it was very near to the boiler-house, exhausters, and governors, and the necessary attention could be very easily given by the man in charge.

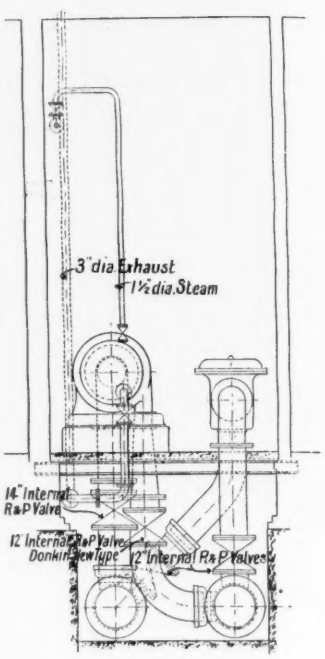
The plant was arranged in duplicate, and designed to deliver 200,000 cubic feet per hour against a pressure difference of 8 inches water-gauge—that is to say, it will increase the pressure from (say) 4 inches on the inlet side to 12 inches on the outlet, and maintain an output of 200,000 cubic feet per hour. This plant was supplied and guaranteed to give the above results by the Bryan Donkin Company, and consists of two Rateau type fans, each of 600 mm. diameter, with 10-H.P. De Laval steam-turbines mounted on the same combination baseplate. The steam pressure is 80 lbs. per square inch, and the speed of the fan 2230 revolutions per minute. It was necessary to excavate to a depth of 7 ft. 4 in. below the floor level for a basement to take the inlet and outlet mains; and great care had to be exercised in underpinning the side walls, owing to the fact of an exhauster and engine running a



ELEVATION.



PLAN.



SECTION.

BOOSTING PLANT AT THE LEA BRIDGE GAS-WORKS.

few feet from the wall on one side and a station meter being fixed on the other.

The inlet and outlet mains are of 20 inches diameter, cast iron, with flanged joints. The low-pressure rising pipes are 14 inches diameter, reducing to the fan inlets, and the connections on the high-pressure side are 12-inch. A 12-inch bye-pass main operates a safety diaphragm valve or governor, and an ordinary 20-inch bye-pass connection with a rack-and-pinion valve. This valve, as well as the two controlling the fans, is fitted with false spindles attached to ordinary valve-standards on the floor level, to give easy operation. The inlet-main is connected to all the holders. They are thus easily changed-over at will. Owing to the special connections required, and the small space available, it will be noticed that special castings had to be largely used, also valves of both internal and external rack-and-pinion type; and, further, the discharge-pipe of the fan is arranged vertically, and passes through the baseplate.

The floor to take the turbines, fans, safety governor, and valve-standards is supported by seven rolled steel joists, each 10 ft. 6 in. long by 6 in. by 5 in. by 25 lbs. per foot run, three joists each 10 ft. 6 in. by 6 in. by 4½ in. by 20 lbs. per foot run, and six framing joists immediately under the baseplates of the fans. Holes were drilled in the flanges to take the holding-down bolts. These joists were laid at various distances apart, under the turbines and fans; the distances varying from 2 feet to 2 ft. 9 in., and others from 3 ft. 5 in. to 3 ft. 7 in., depending upon the positions of the end joists and manholes. The floor was then made-up by reinforced concrete with shuttering of corrugated iron arched up from joist to joist from the bottom flange, with reinforcement sheets of No. 15 expanded steel 3-inch mesh, diamond shaped, which were laid on the top of the joists; the concrete being filled in at a minimum depth of 3 inches. On top of the concrete a ⅜-inch thickness of patent "Durasco" flooring was laid, and also placed round the foundations of the boosters. Owing to the nature of this material, it was an easy matter to arrange for all the corners to be rounded. This gives a very neat appearance to the base and flooring, with the advantage that it is very easily cleaned. The walls are finished with buff glazed tiles.

Three manholes, covered with cast-iron gratings, were left in the floor, so that all the valves and connections under the floor are easily accessible. Gauges mounted on a suitable board were fixed for easy inspection; there being two water-gauges for the inlet and outlet of the booster, two for the outlets of the governors, one dry circular (Bourdon pattern) gauge for the inlet of the booster, and two "Bristol" recording instruments for the inlet and outlet of the booster.

The method of operation is extremely simple. On the operating floor, we have three valve-standards and the safety governor. The valve-standards control the bye-pass and one valve to each fan. Up till now, it has only been necessary to put the booster into operation during the evening demand; and during the day the 20-inch bye-pass valve is open, so that the whole of the gas for the district passes through this valve. At nightfall the turbine is run, and allowed to reach its maximum speed. There is no result shown on the pressure-gauges, as the gas merely equalizes its pressure through the bye-pass. The bye-pass is then gradually closed, until a maximum of 12 inches is shown on the gauge. The amount of closing depends entirely on the steam pressure to the turbine and the draught on the main. The man in attendance has all the pressure-gauges directly in front of him while doing this. The turbines are worked alternately each week, and the controlling valves only then come into operation.

To shut down, all that is required is to gradually open the bye-pass valve, and then shut off the steam to the turbines. The man in charge maintains the pressure of 12 inches on the outlet of the booster by regulating the bye-pass valve, as the steam pressure, of course, varies slightly, causing slight fluctuations of pressure. Also the draught upon the main varies, which no doubt has some slight effect.

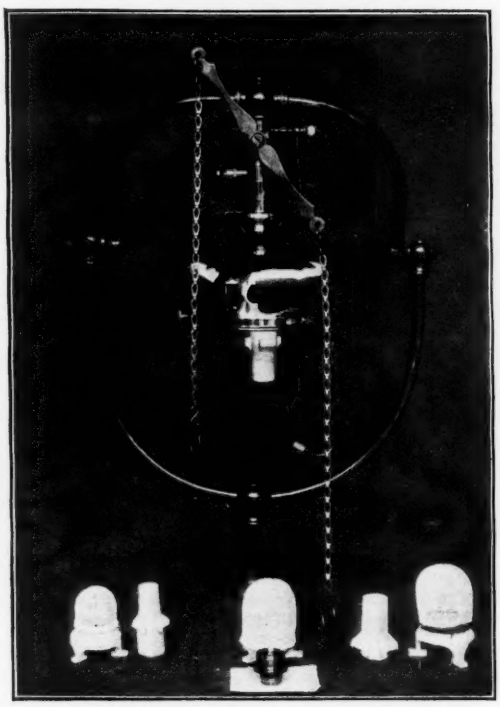
The safety-governor supplied by the Bryan Donkin Company has a 12-inch diaphragm, and is fitted with double cones. It is arranged to open when the booster stops, and immediately the pressure on the outlet falls below the inlet pressure. A counter-balance is arranged so that the unbalanced weight required to open the valve is at the minimum. Four or five small circular weights are placed on a spindle projecting through the top cover; and when putting the fan into operation, it is advisable to raise two of these—thus aiding the valve to close, as, of course, it opens when the outlet pressure drops, which happens directly the fan is stopped.

The plant was erected in November, 1910, and has since worked exceedingly well, enabling a constant pressure of 12 inches to be maintained on the governors. On one or two occasions, our largest holder—which has only two lifts—has uncupped during the maximum demand, when the pressure indicated on the inlet of the booster has been only 2 inches (the top lift of the holder throws 6½ inches), the drop in pressure being due to friction and the draught of the fan in maintaining a pressure of 12 inches on the inlet of the governor and 5 inches on the outlet.

AN IDEA FOR INVERTED BURNERS.

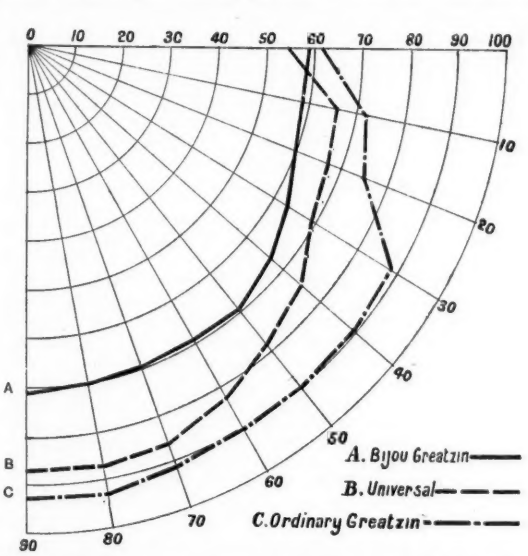
We have a very large variety of inverted burners on the market in size, shape, and style, and also taking glassware of different sizes. This, unfortunately, entails a large amount of work to the storekeeper, in keeping the various replacements required by the maintenance men and fitters. There is also the necessary storage room required, both in regard to the burner parts and the glass used. We have the bijou, medium, ordinary, and Graetzin, each with a different sized globe-gallery; and the patterns and parts of burners differ with the various makers. It appears the time must soon arrive when it will be to the interest of the various gas companies to seriously consider this question of burners, with a view to creating some kind of standard. We know of one London gas company who have already taken this matter in hand, with, I believe, very beneficial results.

As a preliminary step towards the idea of standardization, I



A Burner taking Three Different Sized Mantles.

endeavoured to obtain about three years ago a burner which could be adapted by very simple means to give different lighting values. This, of course, necessitated having various sized mantles and different shaped nozzles to hold the usual standard mantles. We were buying at this time a comparatively cheap inverted burner from a Birmingham house, to compete with the cheap and inefficient burners which were sold at some of the local shops, and, as is generally the case, wasteful users of gas, mantles, and glassware. But in order to suit the composition of our gas (which in a bunsen gives a rather short and intensely hot flame), it was advisable to restrict the distance from the end of the nozzle to the bottom of the mantle; and it was considered that of the two ways possible—*i.e.*, to lengthen the nozzle or shorten the mantle—the former was preferable, so that the consumers could buy the ordinary "Universal" mantles sold at the local stores. Hence a nozzle was selected to give a greater depth than usual between the lug for the mantle-ring and the open end. The thread on the brass portion of the burner was cut to the size and number of the threads on the usual ordinary Graetzin nozzle, so that it could take the Graetzin mantle. A brass extension piece was then made with two outside threads; one being a Graetzin thread to fit into the burner, and the other a smaller thread to take the "Universal" nozzle, as mentioned. This now gave us two sizes of mantles—*i.e.*, the Graetzin and the "Universal." We passed an inquiry for a nozzle to take a smaller sized mantle with the Graetzin thread; and a reducing clay nozzle was made to take the bijou Graetzin mantle. The mantle here referred to is that with the mantle fabric about the same size as the present medium inverted mantle, but with the ring of similar shape to the ordinary Graetzin, excepting, of course, that it is smaller in size.



Illumination Curves taken from One Burner, with Three Different Nozzles and Mantles.

The chart shows illumination curves taken from one burner with these three different kinds of nozzles and mantles. I do not claim exceptional efficiencies in candles per foot; and, further, the test was made on London gas in April last, and the efficiency shown with the "Universal" nozzle was not as good as may be expected from a test by our gas (for which the nozzle was intended), owing, as already mentioned, to the fact of the smaller bunsen flame given and of the greater local intensity of heat. The tests shown on the chart were made with the bare burner only (great care being taken that no outside light should reach the "Flicker" photometer), and without any glass or reflecting material of any kind; so that, of course, with the usual reflectors the lighting value would be considerably increased. A "Flicker" photometer was used with angles; the standard being a movable electric lamp of 14·7 candle power tested by the 10-candle Harcourt pentane lamp. The gas consumption was tested by an ordinary experimental wet-meter. The over-all length of the mantles including the ring, was as follows; and the gas consumption is also given:—

	Inches.		Cubic Feet per Hour.		
Bijou Graetzin	$1\frac{7}{8}$	..	2·7	..	"A"
"Universal"	$1\frac{13}{16}$	..	3·65	..	"B"
Ordinary Graetzin . . .	$2\frac{9}{16}$	..	3·75	..	"C"

A.—"L.B." burner and bijou Graetzin nozzle. Gas consumption, 2·7 cubic feet per hour; pressure, 3 in.; temperature, 67° Fahr.; bar., 30·15 in. Electric standard, 14·7 c.p., tested by 10 c.p. pentane lamp. Overall length of mantle, $1\frac{7}{8}$ inches.

B.—"L.B." burner and "Universal" mantle. Gas consumption, 3·65 cubic feet per hour; pressure, 28-10ths; temperature, $63\frac{1}{2}$° Fahr.; bar., 30·15 in. Overall length of mantle, $1\frac{13}{16}$ inches.

C.—"L.B." burner and Graetzin mantle. Gas consumption, 3·75 cubic feet per hour; pressure, 29-10ths; temperature, $69\frac{1}{2}$° Fahr.; bar., 30·4 in. Overall length of mantle, $2\frac{9}{16}$ inches.

—	A.		B.		C.	
	Candles. Per Foot.	Candle Power.	Candles. Per Foot.	Candle Power.	Candles. Per Foot.	Candle Power.
Horizontal	21·8	58·8	14·6	54 2	16·5	61·7
10	21·8	58·8	18·1	66·0	19·3	72·5
20	22·0	59·5	18·5	67·6	20·2	75·7
30	23·3	63·0	19 0	69·2	23·5	88·2
40	24·7	66·6	20·6	75·1	23·9	89·7
50	25·6	69 2	21·7	79·1	24·0	90·0
60	25·6	69·2	22·6	82·6	24·0	90·0
70	25·6	69·3	23·6	86·0	24·3	91·0
80	25·9	70·0	23·8	86·9	24·7	92·6
90	26·3	71·1	23·8	87·0	24·7	92·6

A peculiarity of the results is the higher values obtained as the angle from the horizontal increases, giving the best values directly vertical. I should suggest that this is due to the comparative shortness of the mantles used, and the fact that the underside of these mantles was very rounded.

Mr. F. Caudwell, in the paper he read before the Association in March last, referred to this burner [see "JOURNAL," April 2, p. 34]; and from his paper I take the following notes:—

The burner will take either a bijou nozzle, consuming 2 to $2\frac{1}{2}$ cubic feet per hour, a "Universal" nozzle, consuming 3 to $3\frac{1}{2}$ cubic feet, or a Graetzin nozzle, which consumes 4 cubic feet. The "Universal" nozzle is the one usually supplied with the burner, which can be sold (with a mantle) at a price to compete with the cheap burners that are on sale by shopkeepers in many districts. A reducing-nipple is supplied, for adapting the burner to the bijou nozzle. The bijou can be used where small units of light are required, and the large Graetzin nozzle, of course, where large units are needed. The burner is particularly suitable where a gas company have a large number of slot-meter installations. A point too, of great importance is the advantage it provides from the storekeeper's point of view. Obviously by having what is practically three burners in one, there will be a great saving in storage space, which, with the multiplicity of burners now on the market, is a matter for grave consideration. The burner is a neat and substantial affair with gas and air regulators. Any of the three sizes of nozzle can be screwed into position in a second or two. With a stock of these burners and three drawers full of nozzles, the maintenance man is in a sound position.

The gas consumption depends entirely on the length of mantle required to be filled, and with shorter or longer mantles than those used in the test the gas burned will be less or greater, with corresponding lighting values. The advantages resulting from the use of a burner of this description appear to be as follows:—

1.—Ease of adaptability in any lighting installation, with the efficiency preserved.

2.—Saving can be effected where less powerful units are desired, without going to the expense of changing the entire burner, so widening the gulf in the saving effected by using gas in place of electric light; the electric lighting of the average private house being in less powerful units than is generally the case with gas.

3.—One size of globe only required; and this with the small mantle would effect a great saving in the cost of replacements, as undoubtedly with the greater distance of the mantle from the glass—together with the small quantity of gas passed through the burner—the possibility of the flame penetrating the mantle, and so affecting the globe

would be remote, which is not the experience we now have with the ordinary bijou size of burners.

The burner is usually sold with the "Universal" nozzle and mantle, as the consumer can very easily purchase this sized mantle from any ironmonger; but where the gas company are able to obtain the maintenance contract for the general upkeep, then the gas company's representative has exceptional opportunities.

As an instance of billiard table lighting, two tables were some five years ago altered from six electric lamps to six upright "C" burners. After about 2½ years, the table was complained of as being insufficiently lighted, notwithstanding that the maintenance was executed by the gas company. The "C" burners were taken off and short adaptors made; and a burner with the bijou Graetzin nozzle was fixed, when the proprietor declared the light on the table was twice as good as formerly—and this with a considerably reduced gas consumption. This result cannot entirely be credited to the inverted burner, as formerly with the "C" burners and chimneys a large clear glass cup—similar to that used with a bulb set for street lighting—was employed to catch the pieces of glass should a chimney happen to break; and this cup, being of good thick glass, undoubtedly obstructed some light. The inverted burner, on the other hand, had a small enamelled iron reflector over it, with merely a wire cage to catch the mantle-ring should it be broken off.

The burner with the ordinary Graetzin nozzle has been successfully used on billiard tables where only three lights are preferred; and in one particular club having over twelve tables, three of these inverted burners have replaced three of the usual upright burners, and have been in use now for over two years. The table is considered to be the best lighted, and consequently is in the greatest demand for play.

In bringing this before your notice, I do so as an idea which appears to be in the best interests of the gas industry, and which will well repay careful work done in this direction.

In conclusion, I have to acknowledge the kind permission of my Chief, Mr. F. W. Cross, M.Inst.C.E., to place before you the details of the boosting plant, and to thank Mr. J. G. Clark (our immediate Past-President) for his kindly help with the colour coefficient box and in standardizing the coloured glasses and papers by Lovibond's standards.

OIL AND GAS PRODUCTION FROM POOR COAL.

The "Del Monte" Process.

The "Anglo-Russian Gazette" for the 19th inst. contains an illustration of an apparatus for converting the waste of coalfields and coals which, on account of their impurities or friable nature, are unsuitable for common uses, into a source of oil, or for producing a smokeless fuel, free from sulphur and other impurities, which can be utilized for domestic purposes. The illustration, accompanied by a description of the process which it carries out—known as the "Del Monte" process—is given below; and the following particulars are taken from the article in our contemporary directing attention to the subject.

It is pointed out that there is a general agreement among scientists and engineers that the distillation of coal at a low temperature yields tar or oil of an entirely different character from that obtained with a high one. The benzene, naphthalene, and anthracene series of high-heat tar disappear, and are replaced more or less by the paraffin series of the low-heat tar or oil, which upon fractionation yields naphtha, burning oils, gas oils, fuel oils, lubricating oils, &c. When coal is externally treated in a retort, a coating of coke soon forms on the interior, and as this coke is a very poor conductor of heat, either the exterior heat must be greatly raised to penetrate to the centre of the mass being treated (in which case a high-temperature tar and coke are formed by the outside layer, and a low-temperature tar and coke by the interior layer of the coal), or the period of time necessary for carrying out the process must be so lengthened that it becomes unprofitable and impracticable. Many devices have been resorted to, and not without some success, to overcome these difficulties; but all the methods adopted have certain disadvantages.

In order to be successful with low-temperature distillation, it is imperative that the mass under treatment should be at an equable temperature throughout; so that no dissociation detrimental to the products may take place. It is claimed that, by the use of a heat diffuser, the "Del Monte" process solves the problem. It is stated that with a heat as low as 500° Fahr., the centre of the retort has been found to be at the same temperature as the outside; and that with many coals all the volatile products which it was desired to extract were obtained—some coals yielding as much as 85 gallons of oil to the ton, and 135 gallons having been obtained from shales and bitumens. The process is a continuous one; and the temperature used being low, the upkeep is much less than by ordinary methods, while labour costs are reduced to a minimum. The use of the diffuser greatly augments the amount of ammonia recoverable as sulphate—from 40 to 60 per cent. of the available nitrogen content of the coal having been obtained, compared with 20 per cent. by the usual distillation processes.

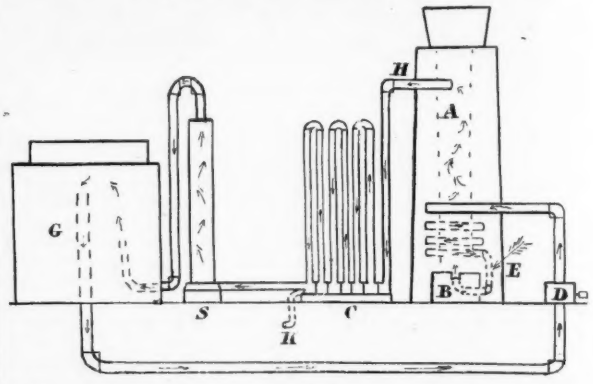
Another claim made for the process is that it produces an ideal fuel, of the same composition throughout, burning freely in an ordinary grate, and giving a bright, cheerful fire which is quite smokeless and free from deleterious fumes. It is considered that its freedom from tar and sulphur renders it specially adaptable for use instead of producer gas; no scrubbing apparatus, so necessary when other fuels are employed, being required.

The parties interested in the process under notice have no hesitation in putting forward the following figures as a safe estimate of the products from 100 tons of average waste coal or slack:

Smokeless fuel	75 tons.
Liquid distillate (oil)	2,500 gallons.
Sulphate of ammonia	2 tons.
Gas (very rich)	600,000 cub. ft.

"The process has been studied as to its commercial possibilities in a most thorough manner, and from the results obtained confidence is entertained that its general adoption would not only revolutionize the coal industry of this country, but would produce a 'Smokeless London' and an infallible oil supply."

The article concludes with some comparative figures in regard to the cost of mining and manufacturing products from one ton of coal and a like quantity of shale. The net profit on the former is put at 16s. 8d., and on the latter at 3s. 4d.—a difference of 13s. 4d. London alone consumes more than 15 million tons of coal per annum; and it is pointed out as a matter worth consideration that if the oil were extracted from this amount of fuel during the year, the net results would not only be what idealists have striven for—viz., a "Smokeless London"—but a yield of over 225 million gallons of oil which could be used for naval purposes, and this without increasing the cost to the coal consumer.



The retort A is filled with the coal dust or other material to be treated, and heated to the proper temperature by means of the producer B. As soon as gas commences to be driven off, it passes through the condenser C and the scrubber S into the gasholder G. From here it enters the return pipe and passes into the exhauster D, which forces it through a heater E built around the flues of the retort. Here it is suitably heated, and brought through the return pipe, and into the bottom of the inner chamber of the retort, where the "crude" material had previously been placed. This heated gas passes up through the material, collecting all the gases formed, and absorbing them. It leaves the top of the retort through the pipe H, and passes through the condenser. Here all the condensable gases are separated from the gas which has been circulated through the retort, and are drawn off from the condenser through the pipe K to a suitable receptacle, while the circulating gas is forced through the scrubber, where it is purified, and again into the gasholder.

This cycle of operations is proceeded with continuously—the circulation of the gas being indicated by the arrows on the illustration. While this gas is being circulated, the retort is being slowly and continuously discharged at the lower end and the coke removed, while fresh coal or dust is being charged through the hopper at the top. Thus the material in the retort is continually in motion.

Manchester University Lectures.—In continuation of the movement originated by the Manchester and District Junior Gas Association, and supported by the Manchester District Institution of Gas Engineers, for promoting scientific work in the University by those interested in the gas industry, lectures have again been arranged for the present session, and the first of the series—"The Physics of the Incandescent Mantle"—was delivered on the 12th inst. by Mr. E. J. Evans, B.Sc. (Manchester). The other three lectures are: "The Mixing of Gas and Air for Lighting and Heating," by Mr. Franklin Thorp, on Dec. 7; "General Observations upon the Construction of Gas-Works and their Equipment," by Mr. W. R. Herring, M.Inst.C.E., on Feb. 1, 1913; and the "Hygienic Aspects of Gas," by Principal J. W. Graham, M.A., of Dalton Hall, on March 1. The lectures will be given in the Chemistry Theatre of the University at 3 p.m. on Saturdays, and admission will be free to all interested in the gas industry on presenting a ticket to be obtained from the Hon. Secretaries of the District Associations (Mr. W. Whatmough, Gas-Works, Heywood, or Mr. J. Alsop "Laymarice," Edgeley Road, Stockport), or from the Bursar of the University.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

Visit to Messrs. Parkinson and W. & B. Cowan's Works.

Last Saturday, about 75 of the members of the Western District Division of the Scottish Junior Gas Association paid a visit of inspection to the Buccleuch Street Works of Messrs. Parkinson and W. & B. Cowan, Limited. The firm kept the works in operation, and the result was that the visit was of a most instructive kind; every facility being given by the firm for a thorough inspection of the different processes in meter manufacture.

The company were received in the Board-room by Mr. Joseph Hepworth, the Manager of the Edinburgh branch of the firm; and, prior to starting in groups on the tour of inspection, he offered a few words of welcome to the visitors. On behalf of his Co-Directors, he expressed his pleasure at so many members of the Association coming to see the works; and although he disclaimed the ability to teach them how to make gas-meters, he guaranteed that they would all be interested in the different processes of manufacture. He mentioned that the Buccleuch Street works were not by any means the most modern of the Company's works; and he pointed to the London establishment, which was shown in an engraving on the wall, as being their most up-to-date centre of manufacture. But since they would come to Buccleuch Street, the visitors must be content. He recalled that, in looking through some papers at home, he came across the programme for the centenary proceedings which took place at Stirling, when the bust of William Murdoch was placed in the Wallace Monument. It was just 120 years since gas was introduced by Murdoch; and they also knew that Clegg was one of the greatest names associated with the manufacture of gas. It was Clegg who devised the first gas-meter—he thought it was called a gauge or rotative gas-meter. That was invented in 1815. Clegg assumed partnership with Crosley in 1816; and Messrs. Parkinson and Co. were the successors of Clegg and Crosley. Now the firms of Parkinson and Cowan were associated, and had been for some years. The works in Buccleuch Street dated from 1827; and in those days the dry meter was not known. The virtues of the wet meter were proclaimed in every trade circular; but in the works the visitors would see both wet and dry meters. He concluded by saying how delighted the firm were to welcome the members, and added that, as an old gas manager, he always took a great interest in their Association.

The company were then divided into groups, and, under the care of members of the office staff, they were enabled to see the manufacture of gas-meters from the rough stage of unfinished metal to the completed article approved by official inspection.

It may be interesting to recall, in connection with this visit, that the works at Buccleuch Street were established in 1827 by Mr. William Cowan, the father of the present Chairman of the Company; and they have been gradually enlarged. These extensions, however, were found totally inadequate to meet the increasing requirements; and factories were opened in London, Manchester, and Sydney (N.S.W.). In 1900, the business was amalgamated with that of Messrs. William Parkinson and Co., of London and Birmingham. Since the amalgamation, other extensions have taken place by the opening of factories in Belfast, Melbourne, Victoria, and Wellington (N.Z.).

The works in Buccleuch Street, as was seen on Saturday, are largely devoted to the production of gas-meters; and these, of all sizes and descriptions, were visible in every stage of manufacture. In addition, there were also on view many other kinds of gas apparatus, including high-pressure meters. The engineering and other shops are of the most up-to-date kind; and, as in the brass moulding and finishing shops, it was noticeable that ventilation was very carefully attended to. Perhaps the most interesting portions of the works were the index and coin-attachment departments. The careful gauging and checking which was in operation was a noteworthy feature. The meter-fitting shop, which occupies two separate floors, was also very interesting. The testing arrangements are also singularly complete; and every stage of the process was open for close inspection. Educationally, the visit was a most successful one, as practically the whole of the 320 employees were at work.

Hospitality of the Firm.

The company were subsequently entertained at tea by the firm in the North British Station Hotel, under the chairmanship of Mr. Hepworth, who was supported by Mr. F. L. M'Laren (the President), Mr. Henry O'Connor, Mr. C. Campbell, of the Buccleuch Street Works, and Mr. David Fulton (the Secretary of the Association).

Mr. W. Blair (Helensburgh), on behalf of the guests, proposed a vote of thanks to Messrs. Parkinson and W. &. B. Cowan for their kindness and hospitality. He referred to the high standard of quality which had been everywhere visible at their works. It was all very well to make gas; but they could not do very much good with it unless they had accurate meters, both ordinary and prepayment. They had seen the latest in the manufacture of both kinds of meters, as well as those for high-pressure gas, which latter he believed would become more common in the near future.

Mr. M'Laren, on behalf of the members, associated himself with Mr. Blair in his thanks to the firm.

Mr. Hepworth, in reply, thanked the members for coming to Buccleuch Street. He was an old gas and water engineer, and it was a great pleasure to him to welcome the Junior Association; and, if his friends in the Eastern District would pardon him saying it, he thought their Western friends had started on the right idea. So far as he had seen, they had been successful; and he heartily wished them "God speed." If he hadto begin his career over again, he would greatly like to be one of their number. In his young days, they had no such Associations as theirs; they had not even the Gas Institute. Though the visitors had not seen anything very striking at Buccleuch Street, there were one or two things of great interest to them as gas engineers. He referred specially to the high-pressure meter. This was one of the things that had been called for by gas managers like themselves. In Birmingham, for instance, the gas from similar meters was used for metal smelting and other purposes. He thought there was a great future for high-pressure meters. Another thing to which he would call their attention was the calorimeter which had recently been brought to perfection. Parliament had empowered a gas company to drop the clause relating to the illuminating power of the gas, and had substituted one relating to its calorific power. It was the first occasion of this being done; and he thought the calorific power of gas would become more and more universal as a standard.

Mr. C. Campbell briefly referred to the interesting and pleasurable nature of the visit, and cordially associated himself with all that Mr. Hepworth had said.

Visit to the Gas Exhibition.

The members subsequently visited the gas exhibition in the Waverley Market. It was expressed on all hands that the day's experiences had been alike interesting and highly valuable from the professional standpoint.

MUNICIPAL WATER-WORKS ASSOCIATION.

First Annual Meeting.

The First Annual General Meeting of the above-named Association, which was formed a year ago to afford representatives of the leading municipal water-works undertakings throughout the country opportunities for co-operation in regard to matters of common interest, was held last Saturday, at the Offices of the Metropolitan Water Board, Savoy Court, Strand, W.C. The Association numbers about a hundred members, representing undertakings serving populations ranging from 50,000 upwards and the majority of them were present. On the 1st inst., the membership represented a total population of 16,280,000.

At the outset, Alderman Bewlay, Deputy-Chairman of the Water Committee of the Birmingham Corporation, occupied the chair.

The Chairman said his position was one of a temporary nature, as he had only to propose for election as the first President of the Association a gentleman who was at the head of the largest water undertaking—Mr. E. B. Barnard, the Chairman of the Metropolitan Water Board.

Mr. Joseph Parry (Liverpool) seconded the proposition; and it was carried unanimously.

The President, on taking the chair, was very cordially received. In the course of a few introductory remarks, he expressed his thanks for his election, referred briefly to the value of the Association, and wished for it a career of usefulness. He then delivered the following

INAUGURAL ADDRESS.

Gentlemen—This is an age of associations, an age when men engaged in different branches of public work band themselves together with one great aim in view—the advancement of the public interest. It is perhaps a singular thing that until the formation of this Association no attempt had been made to organize and bring together the representatives of the great municipal water undertakings, for it might be difficult indeed to find a more fertile field of work; and I venture to entertain the confident belief that great advantage to the community at large will result from our bringing to bear upon the problems and anxieties that beset us the concentrated experience and wisdom of those who for many years have been so actively engaged in providing for the people of this country one of the prime necessities of life. The "man in the street" is but too apt to take for granted the provision of a proper water supply. But the fact remains that the very life of the community depends upon such a supply; and no one knows better than we who are present to-day how huge is the work which has to be performed in order to safeguard and protect that most vital public service.

It may be thought that each particular community is quite able to look after its own interests, and to deal, without the assistance of any outside persons, with the problems which confront it. It may be that London has its particular problems, and that the questions which confront Glasgow are not those with which Birmingham or Sheffield has to deal. Nevertheless, there are many things which, while of first-rate importance to each individual undertaking, can be—indeed, must be—considered from the broader aspect of the whole country.

It may be said that while this is true, the Committee-rooms of Parliament afford ample opportunity for the discussion of matters of this kind. But this I feel would be a partial and inadequate statement of the case; for while each one of us will acknowledge

and deeply appreciate the great care and attention which the Committees of Parliament give to our requests, and the marked ability which invariably characterizes their deliberations, yet the fact remains that there is a vast amount of work which ought to be undertaken before we enter the Parliamentary arena, so that public opinion in connection with water supply may be assisted and guided on lines which have been proved to be sound. Those of us who have had many dealings with the State Departments appreciate to the full how welcome to them are the practical views and opinions of those who, equipped with ripe experience and knowledge, are best able to judge of the various questions which arise from time to time; and I cannot conceive anything but cordial welcome to an Association such as our own, which will provide machinery for the consideration of the great questions connected with the public water supply of this country.

The work of our Association lies in the future, and time will only permit of my indicating in the broadest outline the questions which I hope will be dealt with in due season. That work will, perhaps, naturally divide itself under four main headings: (1) Administration, (2) Public Health, (3) Finance, (4) Physical.

Under the heading of administrative problems, perhaps one stands out with special prominence—that of the constitution of watershed conservancy authorities; for I suppose that no problem is greater than that of apportioning the natural water supplies of the country between the various communities. Hitherto there seems to have been little policy but one of "first come first served." If any large city or town applies to Parliament for powers to appropriate an area or a source, there seems to be no machinery by which the claims of other localities or authorities can be considered, except to the extent to which those localities and authorities can incur the cost of putting their claims before Parliament. Admirable as this procedure may be in its application to individual cases, it nevertheless fails to deal with many important aspects in relation to the country at large; and as the years roll on, and the untouched sources of supply become fewer and fewer, it may perchance be found that a more general consideration of the subject would have been in the public interest. The matter has already been brought forward by the Royal Commission on Sewage Disposal, who, in their fifth report, advocated the establishment of a central authority whose duties should comprise the protection of water supplies from pollution, the collection of information as to water supplies available in various parts of the country, and as to the need of water in different areas. Whatever may be said as to the establishment of a new department or authority to deal with this matter, I think the various problems thus foreshadowed would derive the greatest assistance if they could be discussed in an Association such as we have now formed.

The next department of work to which I have referred is that relating to public health, under which I deal with the question of the purity of our supplies. I suppose every member will admit that the primary aim of any authority responsible for a water undertaking should be the provision of a supply of which the purity is beyond reproach. Here, again, difficulties of infinite variety confront the different undertakings throughout the country. The problems of an authority supplying a river-derived water are not those which have to be dealt with by one whose supply is derived from natural or artificial lakes; and the cares and responsibilities of those who draw their water from wells sunk deep in the chalk are very different from those of undertakings which depend upon peaty uplands. Nevertheless, it does seem to me that a body of men familiar with the difficulties of individual localities would, by a joint discussion of the whole question of the quality of water supplied, perform a work of incalculable benefit to the community at large.

The third heading—namely, that of finance—would bring us to a matter upon which we shall, no doubt, have widely divergent views. But here, again, I think the opportunity of comparing the systems in force in different parts of the country will be of the greatest possible interest and practical importance; and I look forward with a good deal of gratification to the opportunity which I think this Association will afford of enabling one to compare the systems of charge adopted in different parts of the country, and of studying the various aspects of the relationship of the water consumer to the ratepayer, of the domestic consumer to the trader, and other problems of a like character. Under this heading, too, will arise questions which to me are of peculiar interest—namely, those relating to assessment and rating. It is suggested that a question of great practical importance is arising in connection with the assessment of compensation reservoirs. This, perhaps, is only one of many rating problems which confront us; and I hope that during the year we shall have an opportunity of discussing these matters in some detail.

The last heading to which I have referred relates to what I call "physical" questions. Under this heading I include problems relating to the construction of works of all kinds, and the great responsibility of securing a first-class supply from the point of view of quantity. In this matter, as in others, we all have our peculiar difficulties. Nevertheless, I think this is a subject on which we might give one another valuable assistance and ideas in discussing, for instance, such things as the normal consumption per head of population supplied, in describing experiments with apparatus invented from time to time, in dealing with problems of underground water, in recording statistics of rainfall, and in the other innumerable questions which will arise in this connection. It may be even that some of you will desire to look so far ahead as to discuss the possibility of using sea water for non-domestic purposes. I suppose that, sooner or later, if the population of this country continues to increase, this question will become one of "practical politics." It may be that the day is nearer than some of us anticipate; and the question may perhaps be usefully borne in mind in connection with our consideration of the needs of the country as a whole with regard to water supply.

It is impossible, in the time at our disposal this morning, to proceed to the discussion of the various matters to which I have briefly alluded; and this is not the time at which it could be usefully undertaken. None the less, I hope we shall have an early opportunity of discussing some, at all events, of these problems; and perhaps this morning the most useful work we can undertake is to consider how to provide opportunities for their full and adequate discussion.

In conclusion, I can only say this, that I appreciate to the full the vital importance of the work upon which we are entering; and it is therefore with a sense of deep responsibility that I undertake the office of first President of the Association. I regard my election to the office in no personal sense; and I believe that you have done me the honour of electing me in my capacity of Chairman of the Metropolitan Water Board. I am, therefore, speaking on behalf of the largest water authority in the country—probably in the world—when I say that the Metropolitan Water Board appreciates the honour which has been done to it by the water authorities throughout the country, and will always be glad to render any assistance in its power to other municipal authorities in their efforts to provide the water consumers for whom they are responsible with an adequate supply of pure and wholesome water.

The address was very heartily applauded, and a vote of thanks was unanimously passed to the President, who was requested to sanction the circulation of the address among the members.

Mr. ARCHIBALD CAMPBELL, the Convener of the Water Committee of the Glasgow Corporation, was elected Vice-President of the Association, and expressed his thanks.

GENERAL BUSINESS.

The general business on the *agenda* was then proceeded with.

The minutes of the inaugural meeting held on Nov. 24, 1911, having been signed by the President, the report of the Executive (Provisional) Committee was taken as read. In the course of it the Committee said:

> In submitting the report of their proceedings since their appointment at the inaugural meeting held at the offices of the Metropolitan Water Board, on Nov. 24, 1911, the Executive (Provisional) Committee think it may be desirable to refer briefly to the objects of the Association, and the preliminary steps taken prior to the first meeting.
>
> It has been apparent to many of the large municipal water undertakings for a considerable time that there was need for an organization which should afford an opportunity of conference and co-operation in regard to matters of common interest. Similar organizations have been formed, and are available for purposes of this kind, in connection with almost every department of municipal service except water, resulting in considerable advantage to the departments concerned.
>
> Although the multiplication of associations generally is to be deprecated, it was felt that an organization which would provide means for the consideration of important problems affecting municipal water supply had become a necessity. After a number of preliminary conferences, a general meeting of the representatives of municipal waterworks undertakings was held at the offices of the Metropolitan Water Board, at which the Association was formally inaugurated, and the constitution and bye-laws adopted.
>
> Copies of the constitution and bye-laws were thereupon sent to the representatives of the various water authorities, together with a circular-letter inviting them to join the Association. The result was prompt and gratifying; and your Committee are now able to report that already twenty-one authorities, supplying upwards of 16 millions of water consumers, are represented on the Association, out of a total of 23 million consumers in the water area of municipal authorities.
>
> The chief objects of the Association are to bring together representatives of municipal water authorities for the purpose of considering and discussing important questions affecting their interests which are continually arising, and to facilitate the acquisition of experimental, statistical, and scientific knowledge relating to the construction, control, and management of municipal water undertakings. Emergency meetings, to deal with important questions, will be convened from time to time as the necessity arises; and if it is so desired by the members, the Executive will arrange for other meetings at which papers on subjects of common interest may be read and submitted for discussion. If such meetings are considered advisable, papers on the following subjects are in course of preparation by members for submission during the next year:
>
> "The Proposed Constitution of Watershed Conservancy Authorities."
> "The Rating of Compensation Reservoirs."
> "The Insurance Act and its Effect on Large Water Undertakings."
> "Incrustation of Mains."
> "Afforestation of Catchment Areas."

The Committee went on to state that Mr. Charles G. Henzell, of Leeds, and Mr. William Terrey, of Sheffield, were acting as Joint Hon. Secretaries of the Association; and that they nominated Messrs. Henzell, Lees, and Moon for the positions of Hon. Secretary, Hon. Treasurer, and Hon. Solicitor of the Association. They recommended an alteration in the clause in the constitution relating to the nomination of members to serve on the Executive Committee so as to make it more representative. In conclusion, they invited suggestions as to the most convenient date for holding future meetings.

With regard to the paragraph of the report relating to emergency

meetings, it was decided to request the Executive Committee to prepare a scheme for submission to the members. The 29th of September was fixed as the end of the financial year, and the month of October for the annual meeting. The Vice-President proposed that this should be held next year in Glasgow; and the proposition was agreed to. The nominations of office-bearers were sanctioned; Mr. Terrey being associated with Mr. Henzell in the secretarial work. The following are the office-bearers:

President.—Mr. E. B. Barnard, M.A., J.P.
Vice-President.—Mr. Archibald Campbell (Glasgow).
Hon. Secretaries.—Mr. C. G. Henzell (Leeds) and Mr. W. Terrey (Sheffield).
Hon. Treasurer.—Mr. E. A. Lees (Birmingham).
Hon. Solicitor.—Mr. W. Moon (Metropolitan Water Board).
Hon. Auditors.—Mr. R. Hamilton (Belfast) and Mr. C. Arthur (Fylde Water Board).

As the result of a ballot, the following gentlemen (with the addition of the Chairman of the Water Committee of the Birmingham Corporation) were elected as members of the Executive Committee:—

Mr. A. R. Atkey, Chairman of the Nottingham Corporation Water Committee.
Right Hon. Sir William Slater Brown, Lord Provost of Edinburgh.
Mr. J. Cook, Assoc.M.Inst.C.E., Engineer to the Fylde Water Board.
Mr. J. Hollywood, Chairman of the Belfast and District Water Committee.
Mr. Joseph Parry, M.Inst.C.E., Water-Works Engineer, Liverpool.
Mr. A. B. Pilling, Clerk of the Metropolitan Water Board.
Mr. W. Rimmer, Chairman of the Bolton Corporation Water Committee.
Mr. J. K. Sutherland, M Inst.C.E., Water-Works Engineer, Glasgow.
Mr. William Terrey, General Manager, Sheffield Water-Works.
Mr. L. C. Walker, Assoc.M.I.Mech.E., Water-Works Engineer, Reading.
Mr. James Watson, M.Inst.C.E., Water-Works Engineer, Bradford.

The proceedings then closed.

Inaugural Luncheon.

The members were subsequently entertained by the President at luncheon at the National Liberal Club, where they were joined by a unique representation of municipal activity throughout the country, accompanied by a large gathering of distinguished men representing the State, the Parliamentary Bar, and the engineering profession. Mr. Barnard presided. After luncheon, the loyal toasts having been honoured, Sir Melvill Beachcroft, the first Chairman of the Metropolitan Water Board, proposed "The Municipal Water-Works Association," coupling with the toast the name of his esteemed friend Mr. Barnard. The President, in responding, emphasized the importance of water supply, as shown by the fact that the amount invested in municipal water-works is £130,000,000, compared with £23,000,000 in gas-works, £30,000,000 in electric light works, and £36,000,000 in tramways. He said that the Association's object was not competitive. It had been formed in the public interest and to protect and serve the public. Having referred to the future work of the Association, he concluded by wishing it "God speed," and expressed the hope that it would attain all its aims and aspirations. Lieut.-Colonel Porter, Chairman of the Water Committee of the Liverpool Corporation, proposed "The Visitors," coupling with the toast the name of Lord Desborough, the Chairman of the Thames Conservancy. His Lordship responded, and proposed "The Health of the President," whose acknowledgment brought the pleasant function to a close.

Combustion of Ammonia.—In a recent number of the "Revue des Sciences," M. Terni has shown a simple method of demonstrating the combustibility of ammonia. Into a thick walled glass tube, 17 cm. long and 2 to 3 cm. diameter, place 5 c.c. of 30 per cent. hydrogen peroxide, 10 c.c. of a concentrated solution of ammonia, and 1 gramme of finely powdered manganese dioxide. Oxygen is evolved, and the temperature of the liquid rises considerably. The gaseous mixture, composed of oxygen and ammonia, is inflammable. At the beginning, the combustion is accompanied by little explosions; but soon the gas burns with a fine yellow flame.

The Woodall-Duckham Vertical Retorts at Lausanne.—The account given in the "Bulletin" of the Belgian Gas Association, noticed elsewhere, of the visit of certain members of the Association to England to inspect the Woodall-Duckham vertical retorts, contains a table showing the results of the working of these retorts at the new gas-works at Lausanne from the 11th to the 17th of March last—German coal being used. The figures are as follows, the guarantees being given in parentheses: Yield of gas per 100 kilos of coal, 34·74 (33·6) cubic metres; calorific power, 5295 (5073) calories; coke used for heating, 10·55 (16 to 18) per cent.; production of gas per setting per 24 hours, 4248 (3500) cubic metres; production of gas per retort, 1062 (875) cubic metres. The same table contains the results for the past year, as follows: Yield of gas per 100 kilos. of coal, 34·13 cubic metres; calorific power, 5298 calories; coke for heating, 14·48 per cent.

WEAK AMMONIACAL LIQUOR FOR PURIFYING GAS.

In the "Journal" for the 8th inst. (p. 116), it was mentioned that one of the papers submitted at the Eighth International Congress of Applied Chemistry, held in Washington (D.C.) last month, was on the subject of "The Continuous Purification of Coal Gas with Weak Ammoniacal Liquor;" the author being Mr. J. G. O'Neill, of Geneva (N.Y.). We gave only a very brief notice of the communication, together with some figures showing the effect of the process, in the previous issue. A print of the paper has, however, since been received; and we now reproduce it practically in full.

In the manufacture of coal gas, the crude gas from the retorts is pulled by an exhauster through a condenser to free it from tar and considerable ammoniacal liquor, and is then forced by the exhauster into another condenser to rid it of excess heat, then through scrubbers which wash out the ammonia, and finally through the purifying boxes, where it is purified from hydrogen sulphide and cyanogen, on into the holder. In washing the ammonia from the gas, two scrubbers are used—the first scrubber, taking the gas, washes it with gas liquor, which absorbs a small amount of ammonia and hydrogen sulphide from the gas; the second scrubber washes it with fresh water, which completely absorbs the ammonia.

The present practice of purifying coal gas from hydrogen sulphide and cyanogen consists of passing the gas through a mixture of iron oxide and shavings in air-tight boxes, whereby the hydrogen sulphide and cyanogen in the gas combine with iron oxide to form iron sulphide and ferrocyanides. When the iron oxide no longer takes up any hydrogen sulphide, it is taken from the boxes and exposed to the air, whence, by oxidation and the throwing-off of free sulphur, it again becomes active or revivified. This operation is repeated four or five times until the percentage of free sulphur in the purifying material increases to about 30 per cent., when the iron oxide will no longer revivify. In earlier times, the oxide would revivify, and could be used until it contained 60 per cent. of free sulphur; but with the modern practice of making gas at much higher temperatures, the cyanogen in the gas has greatly increased, and a large percentage of the iron goes to form inactive ferrocyanides. By introducing about 2 per cent. of air into the gas before the purifiers, a certain amount of revivification takes place in the boxes, and reduces the number of times necessary to expose the oxide to the air to make it again active.

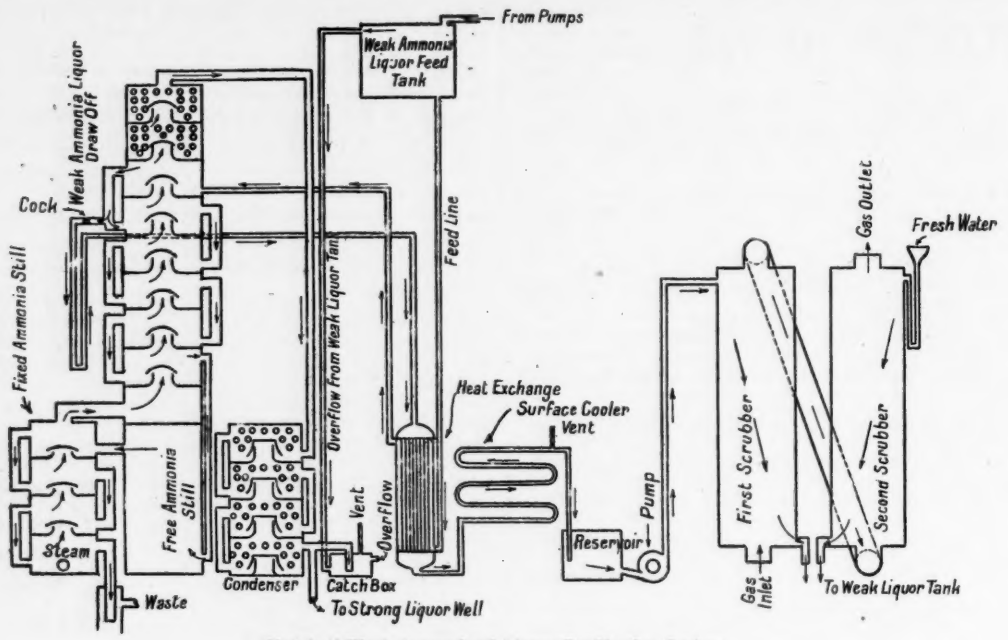
There are many disadvantages which we encounter in the iron oxide method of purification, some of which are as follows: The process is non-elastic; consequently, the normal increase of gas consumption from year to year, the very much greater consumption during certain periods of the year, and the difficulty of obtaining coal low in sulphur—all these conditions are forcing us to increase our purifying capacity rapidly at a very large expense, especially considering the facts that the purifying boxes are extremely bulky, and that many coal-gas plants are already cramped for space. There are also the danger of a gas explosion every time a box is opened and the close attention necessary to prevent the firing of the oxide when exposed to the air for revivification, the cost of oxide and the labour cost in filling and emptying boxes, and the accumulation of spent oxide, which gradually becomes a nuisance.

All these disadvantages of oxide purification have been recognized in the past. Several investigators have devised other purification processes, none of which have met with general approval. Of these attempts, two are of interest to us. The first is by F. C. Hills, whereby he heats ammoniacal liquor* in a special apparatus to 180° Fahr., and obtains a liquor having caustic properties. He washes the unpurified coal gas with this liquor, and absorbs the hydrogen sulphide from it. His process failed because of the loss of ammonia in preparing the caustic liquor, and because of his failure to determine the correct temperature of the liquor and gas during the washing. Had he determined this correct temperature, he would have found that double the quantity of ammonia from a ton of coal would absorb all the hydrogen sulphide in the gas from a ton of coal, instead of six to seven times the ammonia, as is believed to the present time. The other process,† by C. F. Claus, also sought to use the caustic properties of ammonia. He prepared, in an elaborate apparatus, pure ammonia gas, and introduced it directly into the unpurified coal gas before the scrubbers. This process was fundamentally wrong. It complicated gas purification, and increased its cost.

Any advance in the art of gas purification must have for its basis simplicity of operation. It must be more economical of labour, material, and of space than the present oxide purification practice; and to be generally adopted it must be applicable to both the large and the small coal-gas plant. Such a process has been in operation in our plant for the last six months;‡ and I wish to lay before you the manner of operation and the results obtained in its use.

In my method of operation, I absorb the hydrogen sulphide,

* British patents No. 1369 of 1868 and No. 934 of 1874.
† British patents Nos. 7580, 7582, 7584, and 7585, of 1886.
‡ The author, who is the Chief Chemist to the Empire Coke Company of Geneva (N.Y.), described his process last year in "Progressive Age," and it was noticed in the "Journal" for July 25, 1911 (p. 233).



Sketch of Weak Ammoniacal Liquor Purification System.

cyanogen, and some carbon dioxide from the unpurified coal gas by means of a weak alkaline ammonia solution, prepared in an ordinary crude ammonia concentrator. I simply increase the quantity of weak liquor feeding into the ammonia still, and draw off this increase of liquor near the outlet of the first ring, the contents of which have been subjected to the action of steam containing a high percentage of ammonia vapour. We do not interfere with the actual amount of liquor being distilled, or with the operation of the ammonia still. The liquor drawn from this ring is cooled to at least 30° C., and is pumped into the first scrubber, taking the place of the usual gas-liquor wash. The only additional apparatus needed to carry out this process is a cooling apparatus, which consists of a coil with water spray and a small tubular cooler, which cools the liquor coming from the treatment ring of the ammonia still; thus cooling it for use in the first scrubber. The impurities given off by this liquor in the ammonia still saturate the concentrated ammonia in the condenser of the still, while the excess impurities pass off into the air after being washed of all traces of ammonia in the catch-pot.

The effects of washing the crude gas with this liquor are shown by the following data (obtained in a period ranging from Nov. 11, 1911, to Jan. 2, 1912):

Gas liquor to ammonia still, grammes per litre	NH_3—7·00	5·27	4·25	3·87	6·15	7·00
	H_2S—3·20	2·49	1·98	2·31	3·57	3·20
Wash liquor from do., do.	NH_3—7·48	6·93	5·50	4·79	5·98	8·48
	H_2S—1·46	1·12	0·68	0·74	0·80	1·46
Do. from first scrubber	NH_3—7·48	6·83	5·84	5·03	7·82	9·18
	H_2S—6·12	6·00	3·80	4·43	6·13	8·17
H_2S per 100 cub. ft. in crude gas before scrubbers		807·80	703·80	592·10	703·80	557·00	966·90
Do. after scrubbers, do.		276·40	96·30	33·60	44·00	25·00	30·60
Gas washed per hour, 1000 cub. ft.		45	40	35	37	45	44
Liquor wash used per hour, gallons		720	815	700	900	600	900
H_2S eliminated per gallon of liquor wash used, grains		314	298	279	270	399	574

All the cyanogen in the crude gas is eliminated by the liquor wash. On an average, I found the liquor wash absorbed from 0·3 to 0·5 per cent. of carbon dioxide from the gas. My opinion is that this absorption would be greatly increased with a liquor wash containing a higher percentage of ammonia and with a longer time of contact.

The temperature of the liquor wash to the first scrubber must not be higher than 30° C.; neither should the temperature of the gas to the scrubber be higher than this. The best results are obtained when the two temperatures are held at about 25° C., which is the temperature of the gas to the scrubbers we meet with in ordinary coal-gas practice. If gas liquor is substituted for the liquor wash, there is practically no increase in hydrogen sulphide in the gas liquor or decrease of hydrogen sulphide in the gas.

Since our scrubbing apparatus was limited to one fresh-water scrubber consisting of eight bell-shaped compartments, I divided the scrubber—using the four lower compartments for the liquor wash, and the four top ones for fresh water. The results would have been much more satisfactory if I had had one scrubber for the liquor wash and one for the fresh water, as I could then have used much stronger liquor, and would have obtained much higher elimination of impurities per gallon of liquor wash employed, without fear of losing any ammonia from insufficient washing. Another very disagreeable feature of our operation was the uneven make of gas; the amount of gas washed for one hour differing as much as 50 per cent. from another hour of the same day, with little regulation of the liquor wash to meet the increase or decrease in the gas.

Considering all the disadvantages mentioned above, nowhere in the process was there the least possibility of ammonia loss; also, the average yield of ammonia for the six months exceeded the average for the six months previous to the installation of the process. No difficulty was experienced in the operation of the ammonia still. The total amount of steam required to operate the still was not appreciably increased, because the cooling water for the ammonia vapours was practically eliminated.

During the month previous to installing the process, 27 per cent. of the coal used for gas making was a high-sulphur coal. The purifying capacity consisted of three boxes, holding a total of 6000 bushels of shavings and iron oxide. During the month we found it impossible to change the oxide in the boxes rapidly enough to purify the gas from hydrogen sulphide, even using new oxide and introducing some air into the gas before the purifiers.

For the six months after installing the liquor-purification process, the oxide in the boxes was not changed, no labour was expended on purification, the average monthly output of gas for the first three months increased 12 per cent., and for the last three months decreased 20 per cent. (partly due to coal shortage). The percentage of high-sulphur coal used was increased to 50 per cent. of the total; and at the end of this period we found all boxes clean. A very small quantity of air—approximately 0·5 per cent. —was drawn into the gas before the exhausters; but the quantity of nitrogen in this air was more than offset by the quantity of carbon dioxide absorbed from the gas by the liquor wash. The gas issuing from the first purifying box in the series would at times show a trace of hydrogen sulphide; but on changing the flow of the gas, so as to remove this box from being first to receive the gas, it would immediately clean-up. The gas has gone through the boxes for a month at a time without the gas from the first box showing a trace of hydrogen sulphide with lead acetate paper.

During the severe winter weather, the wash liquor in the pipe-line to the scrubber became frozen; consequently for several hours the liquor wash was discontinued. The three boxes went foul, even though a short time before they were all perfectly clean. When the wash liquor was again turned on, the three boxes gradually cleaned-up; proving that by using this liquor wash with a very small quantity of air, the foul boxes could again be made clean, without first passing the gas through a clean box.

The actual saving obtained by using this process is very large, even for a small plant, both in labour cost and using high-sulphur coal. The process is simpler than oxide purification, elastic, independent of one grade of coal, without danger of fire or explosion, does away with any installation of new purifying boxes, and saves valuable space. The gas business being a world-wide industry, any improvement in the manufacture of gas is of world-wide interest. With the modern development of uses for gas, any improvement in its manufacture is a direct aid to the progress of the world.

Southampton Gas Company.—The Directors of this Company, in their report for the half year ended June 30, state that, after payment of debenture interest and other charges, the profit and loss account shows a balance available for distribution of £16,868; and they recommend that the maximum dividends should be paid. This will leave £2000 to be carried forward.

REGISTER OF PATENTS.

Incandescent Gas-Mantles.

ZDANOWICH, J. O., of Knaresborough Place, South Kensington, S.W.

No. 21,315; Sept. 27, 1911.

The patentee claims to have devoted considerable attention to the obtaining of soft, flexible mantles not open to the usual objections, and finds that difficulties are overcome by substituting for the usual cotton, ramie, artificial silk, or other cellulose textiles, as the bases of the mantles, cellulose yarn or fabric which is only partially nitrated. The degree of nitration may vary within limits; but care should, he says, be taken, on the one hand, that it is sufficient to obviate the blackening of the mantle in burning-off, and, on the other hand, that it should not be such as will cause the burning-off to have a disruptive effect on the mantles. As a result of many experiments, he has found that if the amount of nitrogen which determines the degree of nitration be about 6 per cent. satisfactory results are obtained.

The cellulose yarn employed may be either fibrous cellulose, or partially denitrated artificial silk obtained by the original Chardonnet process. The mantle fabric having been knitted from such materials is "impregnated with the salts of thorium and cerium by any of the ordinary processes, and subsequently treated with any suitable precipitating agent to decompose the salts and liberate the oxides which are deposited in collodial form in intimate mixture with the textile material."

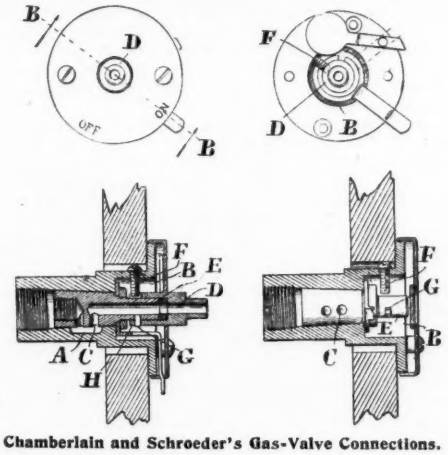
As an alternative, the cellulose fabric may be treated with nitric acid or a nitrating mixture for the purpose of converting it into a partially nitrated cellulose, which is then purified, and treated in order to obtain impregnation with the oxides as described.

Gas-Valves.

CHAMBERLAIN, G. R., and SCHROEDER, A. G., of Grand Rapids, Michigan (U.S.A.).

No. 27,207; Dec. 5, 1911.

These valves are provided with removable couplings for connecting a device to which the gas controlled by the valve is to be supplied; the object being to provide (1) means whereby the coupling may be securely locked to the valve with a packed joint when the valve is closed; (2) means for maintaining the tightness of the joint while the valve is operated, and so arranged that the thrust due to the elasticity of the packing is borne by surfaces which rotate together when the valve is operated—thus avoiding the wear which would occur if only one of the surfaces rotated while the other remained stationary; and (3) means for preventing the breaking of the joint unless the valve has first been closed.



Chamberlain and Schroeder's Gas-Valve Connections.

The body of the valve has an axial opening through it, the inner end of which is provided with a screw-thread for attaching a gas-pipe. The middle portion of the body is tapered to fit the tapered plug—being largest at the inner end and having a lateral recess A. The outer portion of the body is enlarged and provided with a chamber B in which is the outer end of the plug. The larger inner end of the plug is provided with a screw-threaded opening, from which a lateral opening extends to communicate with the recess when the plug is in its open position. The outer end of the plug also has an axial opening which, by a lateral opening C, also communicates with the recess A when the plug is so adjusted. There is thus a channel for the gas to escape through the plug when the lateral openings are opposite the recess, and the channel is closed when these openings are turned away from the recess.

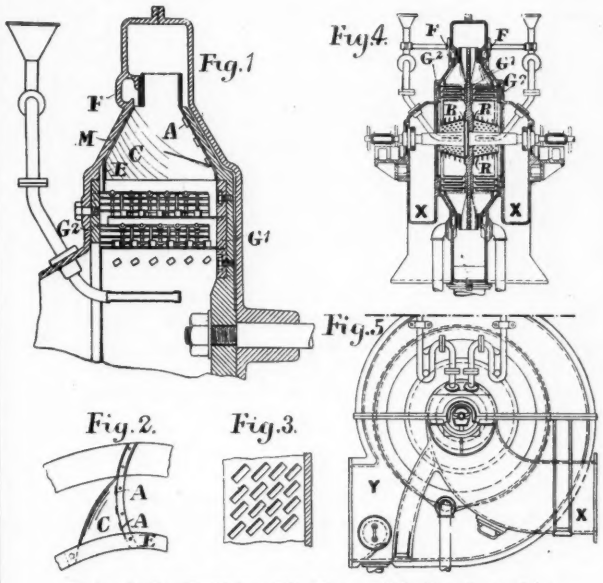
A coupling D is provided with an axial hole extending entirely through it, and registering with the axial opening in the nipple E when the two are assembled. The coupling is held in place by a bayonet joint extending from a recess in which is a spiral, whereby the coupling is drawn closely to place upon the nipple, and between the end of the nipple and the end of the enlargement of the opening in the coupling packing forms a tight joint. The recess is of sufficient width to also receive a screw stop F in the side of the body and extending with its end close to the nipple E. This can occur, however, only when the valve is in the closed position with the pin G turned toward the stop F. After the coupling has been rotated to carry the pin into the slot H, the valve can be turned to the open position, which brings a shoulder I at one side of the recess in the nipple close to the stop F. This stop thus also serves to properly determine the open position of the plug. While the parts are in this position, the coupling cannot be detached; the stop F preventing any further rotation of the coupling in the direction necessary to detach it. Consequently, when the valve is in the open position the coupling is locked in place until the valve is turned to the closed position.

Purifying, Cooling, and Washing Gases.

THEISEN, H. E., of Münich, Germany.

No. 27,696; Dec. 9, 1911.

This is an addition to patent No. 22,433 of 1910—see "JOURNAL" for Aug. 22, 1911, p. 490. Various improved forms of such purifiers are shown with their separate details in figs. 1 to 5 of the accompanying illustrations. In all forms of construction the gases are exposed to centrifugal action in fan or blower like apparatus, in which disintegrator-like devices are provided, in order better to distribute and mix the gas and the washing water.



Theisen's Gas Purifying, Washing, and Cooling Apparatus.

In fig. 2, the fans or blowers C are curved after the manner of a ploughshare, in such a way that the washing liquid and the gas to be purified are diverted from the radial centrifugal direction and thrown at right angles against the washing surface M. By this means the washing surface is more thoroughly utilized. In the form illustrated in fig. 1, the improvement consists in the lower part C of the fan vanes being twisted and having a form resembling a ploughshare, in order to vigorously project the gas against the lateral washing surfaces M, and also being provided internally at the fastening edge with perforations A, which prevent deposition of dust, tar, and like incrustations in the corners of the vanes.

A further improvement, illustrated in figs. 1, 4, and 5, consists in gutters F being provided at the outer edge of the washing surfaces M, into which the water running outwardly off their washing surfaces, and containing the major part of the impurities, is thrown by the centrifugal force and carried off, so that only substantially pure gas is centrifuged radially into the outer fan casing. Power is thereby saved; and it is also possible to again inject water into the path of the centrifugalled pure gas and into the outer fan casing, with the object of cooling, absorption, or the like separately from the actual washing water flowing from the gutter F or the other solid or liquid constituents already separated out. Partitions may also be inserted between the inclined vanes in order to assist the lateral projection of the mixture and avoid radial projection.

According to the present invention, wire gauze cylinders, as illustrated in section in fig. 1, may also be employed more particularly for the stationary cylinders in place of perforated sheet metal cylinders or cones. The bends of these wire gauzes are preferably turned downwards, so that they act as baffle surfaces like the projections R in the 1910 patent.

A further improvement consists in that by this invention the perforated sheet metal or wire gauze cylinders are secured in separate rings G^1 G^2, so that, in case of need, they may be taken out and changed.

In the case of large gas-purifiers (as illustrated in figs. 4 and 5), the fan casing is preferably formed in two parts in a horizontal plane and screwed together; and the rings G^1 G^2, carrying the disintegrator cylinders, are held in such a way by the upper and lower halves of the casing that the rings, after the attachment screws have been undone, may be lifted out upwards with the fan-drum from the lower half casing. The surfaces on which the rings rest in the two halves of the casing must in this case be turned quite flat or plane, so that they, with the fan-drum, may be lifted out upwardly. By this improvement, the "extraordinarily important advantage" is obtained in practice that it is then unnecessary to push the parts of the casing apart laterally. The entire purifier may be taken to pieces upwardly, by lifting off the upper part of the casing and withdrawing the fan-drum and the disintegrator cylinders. If the gas admission pipe X, and also the gas discharge pipe Y, be connected with the lower part of the casing (as illustrated), and the purifier be driven from its right or left hand side—by

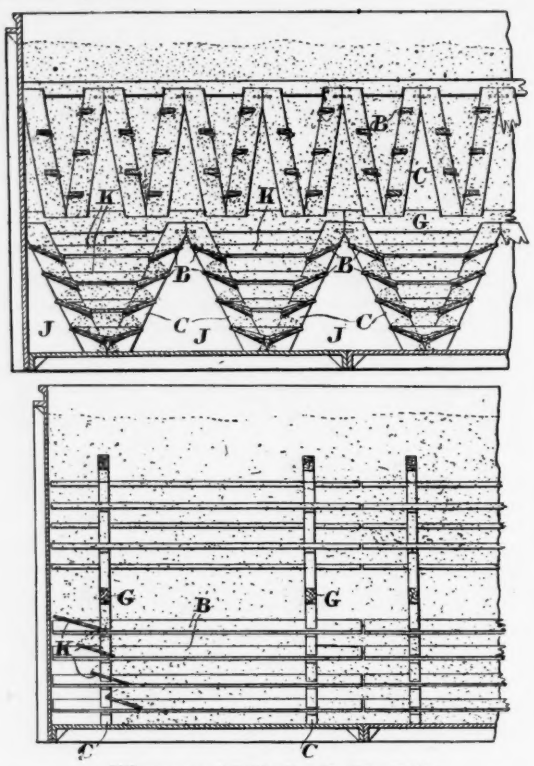
being directly coupled with an electromotor—it is possible, by means of a simple crane, to dismount and change the disintegrator cylinders (where the purifier is formed in two parts and with the arrangement described of the disintegrator rings in the casing and centre division), "as it is then unnecessary to uncouple the pipes for introducing and carrying off the gas, and also the driving gear."

Gas-Purifier Grids.

MILBOURNE, R. J., of Newport, Salop, and BELL, J. F., of Derby.

No. 28,153; Dec. 14, 1911.

The inventors propose to group the grids together in pairs so that the whole area of the floor of the purifying chamber is covered; the ends of the sloping grids adjacent to the sides of the purifier being mitred or bevelled, and the spaces thereby formed closed by grids of triangular shape, "whereby passages are formed which permit of the gas circulating freely over the whole area of the floor of the purifier." The grids have their bars so made and spaced apart that "the material which enters between the bars will come to rest at the natural slope or angle of repose without falling through the bars on to the bottom plates of the purifier."



Milbourne and Bell's Gas-Purifier Grids.

A side elevation is given of a portion of a purifier having the grids arranged in accordance with the invention; also a vertical section.

Each grid is composed of a series of longitudinal bars B (united by transverse beams or battens C) arranged at an inclination to the surfaces of the grids. The grids are arranged in the purifier in an inclined position, so that the purifying material will be supported on the side surfaces of the bars, which are of such a width, and are spaced at such distances apart, that the purifying material will come to rest at the natural angle of repose without passing over the outer edges of the bars and falling on to the bottom plates of the purifier.

Two sets of grids are arranged one above the other; the upper set being supported upon beams G, carried by the lower set. The grids are also arranged with their lower ends substantially in contact; while the upper ends of adjacent pairs are also in contact. The grids of the upper series are arranged at a less angle to the vertical than the lower ones; and the bars of the grids are nearly horizontal. The upper series of grids serve to support the material to a certain extent, so that the whole weight is not carried by the bars of the lower grids, "whereby the material lies much more lightly than would otherwise be the case, greater freedom being thereby afforded for the passage of the gas through the purifier."

The gas is introduced through passages J formed beneath the lower grids; and thence it passes through the grids and through the purifying material. In order to give the gas direct access to all the passages simultaneously, the ends of the lower grids which adjoin the sides of the purifier are mitred or bevelled, and the spaces thus formed are closed by grids K of triangular shape; a passage being thereby formed which connects all the passages.

Manufacturing Carburetted Water Gas.

GLASGOW, A. G.; a communication from JOHN M. RUSBY, of Philadelphia (U.S.A.).

No. 9293; April 19, 1912.

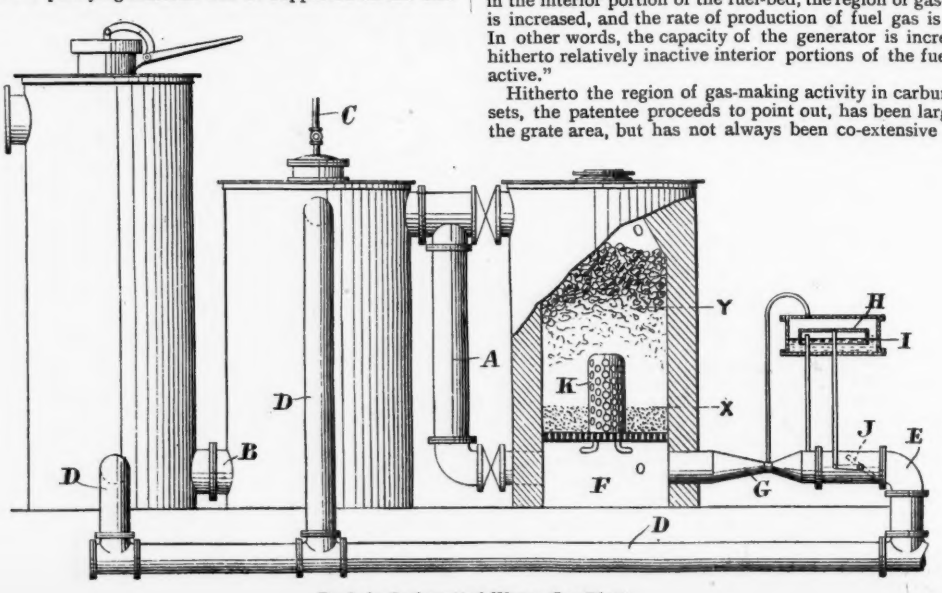
One object of the present invention is (in the words of the patentee) to improve the operation of making carburetted water gas by increasing the capacity of the set per unit of time—in other words, by increasing the yield of carburetted water gas from a set of given size or capacity when used for the manufacture of carburetted water gas by the usual methods. Other objects are to effect economy in the consumption of the hydrocarbons used for carburetting, and to render uniform the production of carburetted water gas on successive runs.

The illustration shows, partly in section and partly in elevation, a carburetted water-gas set embodying features of the invention.

The generator and carburettor intercommunicate by way of connections A, which may bring either the top or the bottom of the generator into communication with the top of the carburettor; while the bottom of the carburettor communicates with the bottom of the superheater by connections B. C is a supply connection for oil to the interior of the carburettor. D are connections for supplying air to the top of the carburettor and the bottom of the superheater. The branch air-pipe E leads to the chamber F, beneath the grate of the generator, and is provided with an air regulator, to automatically keep the volume of air-blast constant. There is a Venturi tube G, the mouth and throat of which are connected respectively above and below a movable member H, arranged in a seal-box I and connected with the damper J. Two steam inlets are arranged—the one near the top of the generator and the other in the chamber F. K is a perforated dome open at its bottom and projecting into the interior of the generator so as to discharge toward the walls. Connections are arranged by means of which the dome may be water cooled.

In working the process, an ignited bed of fuel is established in the generator; and the dome K extends into the interior of the bed to above the ash line or level X, and terminates beneath a superposed layer Y of comparatively cool fuel. During the "blow," the stack-valve above the superheater is open; the oil and steam supply cut off as usual; and the air-blast delivered to the chamber F, and in part rises through the grate and in part through the dome K. If, by reason of the formation of clinker on the surface of the grate (or in any other way), the part of the air which rises through the grate is diminished, the part rising through the dome is correspondingly increased. Where the quantity of the blast is automatically (or otherwise) kept constant, the same quantity of air is passed through the fire at all times either by way of the grate or by way of the dome, or both, without undue increase in blast pressure. Inasmuch as the blasting with air takes place in the interior portion of the fuel-bed, the region of gas-making activity is increased, and the rate of production of fuel gas is also increased. In other words, the capacity of the generator is increased and "the hitherto relatively inactive interior portions of the fuel-bed are made active."

Hitherto the region of gas-making activity in carburetted water-gas sets, the patentee proceeds to point out, has been largely confined to the grate area, but has not always been co-extensive with that area,



Rusby's Carburetted Water-Gas Plant.

because the fuel is less compact near the walls of the generator than it is at the centre; so that there is a tendency for the blast to rise near the walls rather than to go through the centre. The supply of fuel at Y is relatively cool in respect to the fuel below it, and in this superposed supply or layer of fuel sensible heat from the gas passing through it is stored; but combustion of fuel gas from carbon monoxide to carbon dioxide does not take place. The fuel gas so generated, which is of relatively large volume, is burned in the carburettor and superheater along with an appropriate supply of secondary air, so as to preheat these chambers; and the waste products of combustion escape through the stack-valve. During the "run," the air supplies are cut off; steam is introduced; the off-take for carburetted water gas is opened; the stack-valve is closed; and oil or hydrocarbon is introduced. The steam is introduced to the extended region of gas-making activity at the interior portion of the fuel-bed; so that blue water gas is generated in increased quantity. This increased quantity of blue water gas is carburetted and fixed in its passage through the carburettor and superheater; and thus the capacity of the carburetted water-gas set per unit of time is increased.

By this method of blasting in the interior of the fuel-bed, the following results are said to be attained: First, an increased quantity of heat is stored in the fuel-bed, which increased quantity of heat is available for making increased quantity of water gas when the steam is applied. Second, an increased quantity of fuel gas is provided for appropriately heating a fixing chamber or chambers in which the increased quantity of water gas is carburetted and fixed. Thus an increased quantity of carburetted water gas is produced.

The patentee, in conclusion, states that he is aware that it has previously been proposed, in water-gas making apparatus other than carburetted water-gas making apparatus, to employ a grate with a perforated dome open at the bottom and projecting therefrom into the interior of the generator; and he is, moreover, aware that it has been proposed, in carburetted water-gas apparatus, to employ means comprising Venturi tubes in combination with appliances for indicating, but not for automatically controlling, the intensity of the air-blast.

Leak-Detector for Gas-Meters.

GLOVER, J. W., and GEORGE GLOVER AND CO., LIMITED, of King's Road, Chelsea.

No. 2875; Feb. 3, 1912.

It is known in connection with gas-meters, the patentees remark, to provide means for affording an indication when gas is passing through the meter at times when gas is not being consumed—in other words, for affording an indication when leakage from the pipes or elsewhere in the system is taking place. Such means have heretofore taken the form of discs or arms which are driven at suitable speeds by the meter mechanism, and which are so placed that they can be observed through a window or opening. The present invention provides a type of detector which is combined with the index mechanism so that the index mechanism and leak-detector form a self-contained whole, which is driven by the driving spindle of the meter mechanism as heretofore.

Fig.1.

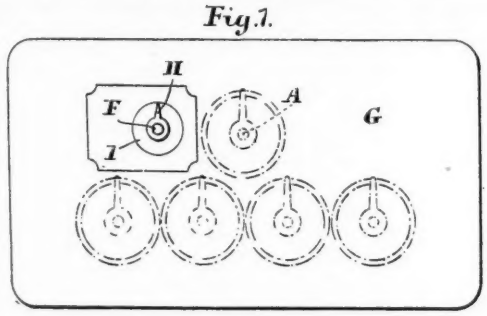


Fig.2.

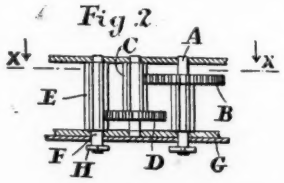
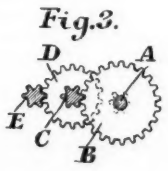


Fig.3.



Glover's Leak-Detector for Gas-Meters.

Fig. 1 is a front view of an index-plate provided with an additional finger and dial, shown in full lines, as required by the invention. Fig. 2 is a plan view of part of the gearing comprised in the counting mechanism. Fig. 3 shows a section on the line X of fig. 2.

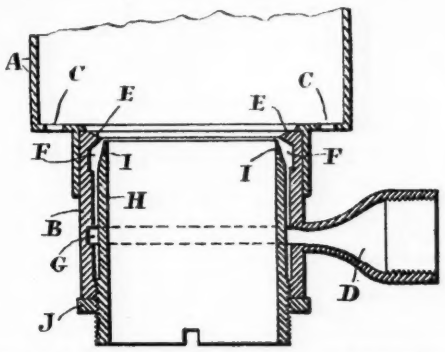
A is the first motion shaft of the counting mechanism, having a toothed wheel B fast thereon in gear with a pinion C, which is fast with a wheel D gearing with a pinion E. The spindle F of the pinion E projects through the dial-plate G and carries a finger H, which is moved over a dial I by the mechanism, when actuated by movements of the meter mechanism. The gearing B, C, D, and E acts as multiplying gearing, to facilitate the detection of small movements of the meter mechanism; and the velocity ratio of this gearing is selected so that the movements of the finger H are sufficiently rapid compared with (for example) the movements of the first motion spindle A that even a small leakage of gas passing through the meter will be readily noticed. It also enables the inspector by an observation of a few seconds' duration to see whether gas consumption is being recorded.

Atmospheric Gas-Burners.

SOUTH METROPOLITAN GAS COMPANY and CHANDLER, D., of Old Kent Road, S.E.

No. 10,371; May 1, 1912.

To provide a silent atmospheric or bunsen burner suitable for use in gas fires and lamps, the patentees provide a gas injector or nipple of annular type, the conical edge of the liner of which is capable of extending past the narrowed edge of the outer ring before the annular space between is closed; while below the flange which narrows the ring at its outlet there is an internal circumferential groove and another internal groove at the height of the gas-inlet. The position and dimensions of the flange are such that the tapered edge of the liner can be shifted so as to project through the space within the flange before the annular space between the flange and the liner is entirely closed. In this way an annular jet of gas is directed in a hollow vertical column along the mixing-tube—"being regulated to any degree of thinness with great facility."



Chandler's (South Metropolitan Gas Company) Atmospheric Gas-Burner.

The mixing-tube A fits on to the outside of the metal ring B, and has air-holes at C. The ring B, which is attached to the gas inlet or branch D, has an inwardly projecting flange E near the top and an internal circumferential groove F just below it. G is another internal circumferential groove in line with the inlet pipe which opens widely into it so as to spread the gas. H is a liner screwed into the ring B and providing an annular space for gas between it and the ring above the screw. The space is adjustable at the inlet to the mixing-tube by the endway movement of the liner within the ring; the liner being coned externally at I to co-operate with the flange E, and being capable of projecting slightly above the upper edge of it. J is a locking ring or nut, for fixing the liner in position when adjustment has been effected.

A nipple for bunsen burners is thus provided, the patentees remark, from which the gas issues into the mixing-tube in a vertical annular stream meeting the air which enters through the interior of the liner, which is entirely open, and also the air which enters by the holes C in the mixing-tube.

APPLICATIONS FOR LETTERS PATENT.

23,387.—TOOGOOD, H. J., and ROBERT DEMPSTER AND SONS, LTD. "Retort-settings." Oct. 14.

23,412.—WILKINS, A. P., "Combined gas cooking-stove and radiator." Oct. 14.

23,482.—SCHOFIELD, L., "Gas-heated wash-boilers." Oct. 15.

23,484.—HEATH, A. W., and HARRISON, C. H., "Burner and fringe or shade holder for incandescent lighting." Oct. 15.

23,516.—MAIR, G. S. M'L., "Globes and shades." Oct. 15.

23,523.—MÉKER, G. A. H., "Heating liquids by gas." Oct. 15.

23,536.—M'COURT, C. D., and BONECOURT SURFACE COMBUSTION, LTD. "Heating by gaseous combustion and furnaces therefor." Oct. 15.

23,538.—SHAW, W. & W. H., and PROSSER, H. R., "Making connections to gas-mains." Oct. 15.

23,554.—MESSENGER, J. H., "Preventing the bursting of pipes through frost." Oct. 15.

23,555.—TIXHON, J., "Shades or reflectors." Oct. 15.

23,592.—JARROTT, C., "Pipe-joints." Oct. 15.

23,613.—HARGREAVES, T. W., "Gas-boiler." Oct. 16.

23,641.—M'COURT, C. D., and BONECOURT SURFACE COMBUSTION, LTD. "Water-tube steam-generators." Oct. 16.

23,642.—KIRKE, P. ST. G., and BONECOURT SURFACE COMBUSTION, LTD. "Steam-generators." Oct. 16.

23,651.—NEW VACUUM HEATING COMPANY, LTD. "Thermostatic valves." Oct. 16.

23,656.—H. LIESE (FIRM OF). "Measuring gases." Oct. 16.

23,695.—JENNINGS, W. E. A., "Stopcock." Oct. 17.

23,778.—MIDMORE, F. C., "Pipe-joint." Oct. 17.

23,819.—HILLS, W. F., "Atmospheric burners." Oct. 18.

23,853.—BOUSFIELD, J. E., "Gas-producers." A communication from Herbert Akroyd Stuart and Charles H. A. Stuart. Oct. 18.

23,862.—GILL, G. M., "Breaking-down clinker in furnaces of gas-producers." Oct. 18.

23,866.—FISCHER, P., "Gas-stoves." Oct. 18.

23,924.—GLOVER, W. T., BERRY, J., and METERS LIMITED, "Piston packing." Oct. 19.

The Directors of Meters Limited have declared dividends at the following rates per annum on account of the dividends for the current year: On the preference shares, 5½ per cent.; and on the ordinary shares, 4 per cent.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Origin of the "B. C. G. A." and Mr. Carpenter.

SIR,—There is a phase of this question which I believe has an important bearing on the future of the Association and on the interests of the gas industry, but which, merely from the personal or reminiscent points of view, is, of course, not apparent.

It will come as a great surprise to many of the present leaders of the movement to be told that Mr. Carpenter was closely associated with, and was indeed largely responsible for, the inception of the initiatory proceedings which directly led up to the formation and the ultimate development of this remarkable organization. But I think that anyone who impartially reads this letter through will agree that the statement is correct.

Some time prior to the valuable inquiry conducted by Professor Lewes into the comparative hygienic advantages of gas and electric lighting, Mr. Carpenter, in a conversation I had with him, raised the question of the hygienic effect of the gas-flame upon the surrounding atmosphere. He requested me to investigate it, with a view to ultimate publication of the results.

My researches into the work of contemporary writers on hygiene were reported in an article published by the "JOURNAL" in 1902—my article embodying extracts from the "Lancet," the "British Medical Journal," Dr. Whitelegge's "Public Hygiene" and Professor K. B. Lehmann's "Practical Hygiene." The article also formed the basis of the pamphlet, "A Ray of Light," for which a third edition (up to 100,000 copies) was called for within eight months. Later on this was followed (by request) by a reprint of the section devoted to the "Hygienic Considerations," under the title of "Will it Pay?"

The pamphlet—thus originated and suggested by Mr. Carpenter—was, undoubtedly, the first effort ever made to explain to the gas consumers of Great Britain, in popular terms, the great hygienic (and sterilizing) advantages of the gas-flame. I claim also that the pamphlet (owing to the form in which it was produced) afforded—circulating, with its fellows, to about 250,000 copies—the first practical and important example of co-operative gas advertising; and it was the direct cause of the proposals to this end which later on it was my privilege to bring before the gas profession. I, incidentally, call to mind with genuine pleasure the cordial and very full support which was kindly given to the production of this and the companion pamphlet "Heat Rays" by Mr. John W. Field, the then Secretary of the Gaslight and Coke Company, and by Mr. Milne Watson, his successor. The subject-matter of these pamphlets is still "current ammunition" for salesmen; for I see that Mr. Bezant includes most of the extracts referred to in his excellent "Competition Points" recently published—a work which should be in the hands of every officer of the sales departments of the gas industry.

Again, I believe it was at the same interview that we conversed together on the subject of a laboratory for investigating into the possibilities of gas for use in technical and other trade operations—such laboratory to be run on co-operative lines for the benefit of the whole industry. This was a subject brought up as new at the recent conference in Manchester. Mr. Carpenter, I know, interested himself greatly in this proposal, and worked hard for a time for its consummation.

Mr. A. E. Broadberry, at the Manchester conference, made a kindly (and may I say a timely) reference to myself.* But his statement was a little too condensed to reveal the salient facts. In the autumn of 1908 I was invited to read a paper, on "Advertising in Relation to Gas Supply," before the members of the Southern District Association. This followed Mr. Goodenough's Institution paper read at Dublin. But nothing definite resulted either from the Institution paper or from my own. In 1909, at the request of the Commercial Section of the Southern District Association, I introduced the subject a second time; and a very interesting discussion followed, which, however, again promised but little definite fruition. I, therefore, decided to at once clinch the matter by moving, there and then, a resolution to the effect that the Committee (*i.e.*, of the Commercial Section) be requested to consider the possibilities of a scheme for co-operative gas advertising for the whole industry, and report.

The resolution was put and carried unanimously; and from that day up to the present time, the inception, formation, and development of the "B. C. G. A." has proceeded stage by stage—by conference among the united commercial sections, and in the hands of the Institution of Gas Engineers—without one single set back. Well did Mr. Broadberry state on Oct. 9 that, "had it not been for the Southern Association, the British Commercial Gas Association would not now have been in existence."

Mr. F. W. Goodenough, when opening the discussion on my 1908 paper to the Southern District Association, referred to my pioneer work in gas advertising of previous years. It is, of course, obvious that the generous recognition by the Southern District gas engineers of what I had endeavoured to do in this direction, was responsible for the honour they conferred on me by their two-fold invitations to address them on the subject. It is also evidence of the great importance they attached to this department of a gas administrator's work. And I think your readers will not only pardon, but they will now subscribe to, my contention that in the glorious result of the recent conference, we trace this ultimate fruition indirectly of the work and aspirations of many individual workers for the industry, and directly of that of Mr. Carpenter in investigations he set on foot years ago—a result, which, however magnificent, it has taken many years to bring about.

And how could any progressive undertaking afford to wait all these years while the industry was slowly turning itself about—ultimately and so laboriously being brought to a sense of its own responsibilities? This, of course, has been impossible; and so the Gaslight and Coke Company, the South Metropolitan Company, and other London and many provincial undertakings have for years carried on most extensively organized advertising propaganda, that have benefited the whole of the industry throughout the world. My own undertaking here can trace distinct and emphatic benefits arising directly from the aggressive and educational work of the South Metropolitan Gas Company; and I have no doubt that most of the small provincial gas undertakings throughout the country can likewise trace material assistance from the advertising work of this and of other London companies and of those who are serving large provincial centres of population.

While wishing the new Association every success, we must not forget the enormously expensive pioneer work already undertaken by many companies, and to which, to a very considerable extent, they are still committed. And I would most strongly urge upon all concerned, within the sphere of the Association's operations and outside them, to study that every utterance, verbal or written, in reference to their friends, in membership or otherwise, shall be consistent only with the true and best interests of the industry. The moral effect of an apparently divided front has to be reckoned with. It cannot be helpful to us. Not unreasonably, many think that it must be detrimental to us. In any case, there is neither call nor reason to suggest to our competitors that we are anything but of one mind—viz., to stand by one another in the cause of our great and honourable industry. In this, we are unanimous and determined.

If the relations between all parties in the industry be based on this principle, I have the strongest confidence that in course of time we shall be equally unanimous as to our methods of conducting, in co-operation, our fighting propaganda.

Chichester, Oct. 23, 1912. T. E. PYE, F.C.S.

* See "JOURNAL," Oct. 15, 1912, p. 183.

Oxidation Tube for Determining Methane and Hydrogen.

SIR,—In the issue of the "JOURNAL" dated Oct. 22, an abstract is given, on p. 292, of a paper by Hempel, in which the use of a new type of oxidation tube for the determination of methane and hydrogen is described. I should like to draw attention to, and place on record, the fact that I have employed a very similar (but, in my opinion, superior) form of apparatus for a considerable period.

The following is a description of the tube I employ: A and B are terminals of molybdenum, fused into the silica tube. Molybdenum is the only metal which can at present be satisfactorily fused into silica tubing. C D is a fine platinum wire, which is heated to incipient whiteness by the passage of a current of about 2 amperes. E is a very small spiral spring, which takes up the expansion of the platinum wire on heating. If the spring is not inserted, the wire sags against the wall of the capillary, and does not heat properly.

I have been able by means of this tube to effect what I consider to be improvements in certain methods of gas analysis; and I am proposing to publish some account of the experiments at their conclusion. The publication by Hempel, to which I have referred, leads me to make this statement at once for the above-stated reason.

The use of the silica-platinum capillary has enabled me to perfect two new types of apparatus for the examination of mine air. These are now being placed upon the market. I have also carried out a number of experiments on the rapid and complete estimation of gaseous mixtures. These experiments are nearly completed; and I shall be happy to give some account of them should you consider the method of interest to your readers. Messrs. Alexander Wright and Co. have undertaken the sole manufacture of these various types of apparatus, in which this silica capillary is employed.

LEONARD A. LEVY, M.A. (Cantab.), D.Sc. (Lond.), F.I.C.

Westminster, Oct. 24, 1912.

[We shall be very happy to receive from Dr. Levy for publication the suggested article describing the experiments and the results to which he refers.—ED. J.G.L.]

Starting-Up Retort-Settings.

SIR,—Having not the remotest idea who "Almea" is, I venture to call in question some portions of his article under the above heading in your issue of the 22nd inst., and for the particular reason that the difficulty of obtaining any reliable guidance as to the methods to be adopted and the precautions to be observed—other than that afforded by practical experience—may induce some of your younger readers to rely in the first instance upon the advice tendered by "Almea," when they become personally responsible for the operations under discussion.

Down to the third paragraph, under the head of "New Work," "Almea" may be safely followed; but he will be lucky who escapes disaster if he acts as directed in the third and following paragraphs, and opens the secondary-air slides, even to the "small extent" recommended, keeps his damper slides closed, and only clinkers his "slow fire" once a week.

Paragraph 5 is too indefinite to be useful, and so is dangerous to follow. There is a safe and certain indication to be observed in order to know when secondary-air slides may be opened, and the cover of the feeding door put on; and without such an indication there is always risk of explosion. It does not always occur, fortunately! But the risk is there; and it is never "safe" to thus close-in the furnace, and admit secondary air until the bottom retorts of the setting are at a dull red heat.

The advice tendered as to Sunday stops is that of a tyro. There is no need to interfere with the dampers, and thus completely upset the working of the settings, if the primary and secondary slides are closed to about one-fifth—the usual amount—and the furnaces filled up with small coke (not breeze dust). Everything will go smoothly when the slides are readjusted at starting; and there will be little or no loss of temperature in the setting to make-up before getting the usual "make" of gas.

I will not take up space by going over the remaining paragraphs in

detail; but the final dictum reveals the inexperience which accounts for the other absurdities. "There is no reason why the furnace should not be completely filled *if so desired*" [the italics are mine]. What is more desirable in a regenerator-furnace than to have it completely filled up to the springing of the crown, and what is more difficult of attainment with such human material as stokers are generally made of?

Oct. 25, 1912. A. P.

Mr. MacLaren's Address to Scottish Junior Association.

SIR,—It is only right that you should publish the fact that Mr. MacLaren, at the close of his address, did acknowledge the source of his information, and thanked Messrs. John Wright and Co. and others for the valuable information with which they had supplied him on the subject of gas-fires. There is therefore no question of Mr. MacLaren trying to pose as a pioneer in the development of gas-fires.

Regarding my own remarks, I might mention that the meaning I wished to convey was that "had the makers of gas-fires twenty years ago understood the fundamental principles of gas heating as they understand them now, we would have enjoyed the blessing of good gas-fires for twenty years, instead of the past few years only." I have no desire to disparage good work done by makers who are carrying out scientific investigations at great cost. On the contrary, I believe they ought to be encouraged in their pioneer work; and manufacturers who are doing it are also showing their anxiety to bring the gas-fire to the state of perfection which will meet with the universal approval of the general public who are our consumers.

Glasgow, Oct. 24, 1912. A. H. WHITELAW.

PARLIAMENTARY INTELLIGENCE.

JOINT COMMITTEE ON GAS RESIDUAL PRODUCTS.

In the House of Lords, on Monday last week, the message received from the Commons, just before the recess, on the subject of the appointment of a Joint Committee to deal with the question of the residual products of gas manufacture, was considered; and it was resolved, on the motion of the Chairman of Committees, to concur in the following resolution of the Lower House: "That it is expedient that a Select Committee of five members of the Commons be appointed to join with a Committee of the Lords to consider whether any, and, if any, what, restrictions should be imposed on gas authorities with respect to the purchase and manufacture of the residual products resulting from the manufacture of gas by other gas authorities, or of other chemicals." A message was ordered to be sent to the Commons to acquaint them with their Lordships' concurrence in their resolution.

Further Progress of Bills.

The Water Orders Confirmation Bill [Lords] has been referred to a Select Committee of the Commons, consisting of Sir Henry Kimber (Chairman), Mr. Morton, Mr. Gershom Stewart, and Mr. F. M'Laren; to meet on Thursday next.

The order for the third reading of the Gas Orders Confirmation (No. 1) Bill [Lords] has been read and discharged, and the Bill referred to the former Committee.

The Gas Orders Confirmation (No. 2) Bill [Lords] was reported, with amendments, on Thursday [Provisional Orders confirmed], considered as amended on Friday, and ordered for third reading yesterday.

GAS ORDERS CONFIRMATION (No. 2) BILL.

This Bill, which confirms Provisional Orders granted by the Board of Trade to the Cambridge University and Town Gas Company, the Cleethorpes Gas Company, the Tipperary Gas Company, and the Welwyn, Knebworth, and District Gas Company, was considered last Thursday by an Unopposed Bills Committee of the House of Commons presided over by Mr. WHITLEY. The Bill has already been passed by the Unopposed Bills Committee of the House of Lords [see "JOURNAL," July 30, p. 336].

Cambridge Order.

Mr. BONNOR MAURICE, on behalf of the Board of Trade, in presenting this Order, drew attention to the co-partnership scheme provided for under Part II., which is on the lines of the scheme in the Enfield Gas Act of 1911. There had been a doubt in the minds of the Board as to whether they had the power to put a clause of this sort in a Provisional Order; but after very carefully considering the matter, and consulting the Speaker's Counsel, and also Counsel to the Lord Chairman, they came to the conclusion that it could be inserted.

The CHAIRMAN: Is this the first case?

Mr. SEDGWICK (Messrs. Rees and Frere, Parliamentary Agents): Yes, so far as a Provisional Order is concerned.

Lord ROBERT CECIL: Why is it necessary to put it in?

Mr. SEDGWICK said the clause in question did not give power to start the scheme, but was merely to enable the co-partners to dispose of the stock which they hold by nominations. They would nominate somebody to take over the stock when they die; and it also enabled the Directors to deal with the co-partnership stock when a co-partner died intestate, without having made a nomination. The London Gas Companies had something of the sort, and Enfield had almost the same provisions.

Lord ROBERT CECIL: Does this provide for electing workmen directors?

Mr. SEDGWICK: No, that is already provided for. Some of the workmen are trustees for the scheme—they are not exactly directors. This is done without statutory powers.

The Order was passed.

Cleethorpes Order.

Mr. BONNOR MAURICE, in connection with this Order, said the Board of Trade had looked carefully into the amount of the new capital—viz., £80,000; and after a meeting of all parties concerned at the Board's offices, it was agreed that it was a reasonable amount. As a matter of fact, the promoters originally asked for much more. It was anticipated that the sum sanctioned would carry the Company on for from eight to ten years. The Local Authority raised no objection. The Company were taking on additional obligations by reason of the extended area. The present population was 25,000; but under a new drainage scheme, provision was made for 75,000. It was therefore clear that a heavy increase was contemplated. The price was a differential one with regard to the new area—there being a 6d. increase. They were a sliding-scale Company; and the standard price was 3s. 6d. per 1000 cubic feet.

The CHAIRMAN pointed out that apparently there was no alteration in the existing standard price, although the new test-burner was being adopted. He also noticed that the candle power was 14. Did the local authority appear at the inquiry.

Mr. BONNOR MAURICE: No.

The Order was passed.

Tipperary Gas Order.

Mr. BONNOR MAURICE pointed out that although it was an Order promoted by a Company, it contained a clause authorizing the Local Authority to raise money for the purposes of repaying certain expenses incurred in opposing a number of Provisional Orders promoted by the Company in past years; the repayment being spread over a period of five years. The clause was not in the Order as originally presented, but had been inserted by the House of Lords Committee before whom the Council opposed the Order [see "JOURNAL," July 23, p. 274]. The clause had been inserted after very careful consideration by the authorities of the House.

Lord ROBERT CECIL remarked that this was a most unusual course.

Mr. BONNOR MAURICE said it was not altogether uncommon. It was put into the Bill now not at the instance of the Board of Trade, but at the instance of Parliament.

Lord ROBERT CECIL: It seems a very odd arrangement to me.

Mr. E. MOON, K.C. (Speaker's Counsel), said there was a similar instance in the case of Falkirk. The Local Authority there applied for an extension last year; but they did not get it. Their costs had to be paid by somebody; and this year they asked for another extension, but again they did not get it. They did, however, obtain a clause authorizing them to borrow money for repaying the costs.

Lord ROBERT CECIL said Tipperary was a different case from this, because the Council were getting power to borrow money for their costs in opposing Bills or Orders promoted by a Company.

The CHAIRMAN said he agreed that it was an odd arrangement.

Mr. BONNOR MAURICE said that the Local Authority petitioned against the Order in the House of Lords; but the parties came to an agreement, and the Lords Committee agreed to put in this particular clause. As he had already pointed out, it was not put forward by the Board of Trade, except nominally.

Lord ROBERT CECIL said that no doubt if the Speaker's Counsel had looked into the matter it was all right; but it seemed curious, because the ratepayers had no opportunity of considering it

Mr. E. CAMPBELL COOPER (Messrs. R. W. Cooper and Sons, Parliamentary Agents) said the Company had agreed to the clause going into the Order, because there had been long opposition on the part of the Local Authority, and they did not wish to run the further risk of having the Bill emasculated or thrown out by objecting to the clause going in. He was afraid that if the Committee now were to disturb the arrangement there would be trouble in the House. It also obviated the expense of the Council promoting a Special Bill for the purpose.

Lord ROBERT CECIL: I do not want to be a spoil-sport at all; but I must say it seems to me a very odd arrangement indeed. The Company and the Council fix what is substantially a burden on the ratepayers without any consideration by them—it may be right or it may be wrong.

Mr. MOON pointed out that the ratepayers would have to pay the costs in any event; the question was whether they should be paid in one year or spread over a period of five years.

Lord ROBERT CECIL said he understood that. But this was a public Bill, and no notices were required; so that the ratepayers really did not know what it contained. He ventured to suggest that if the Committee sanctioned it now, it should be made quite clear that this was an exceptional case, and must not be taken as a precedent.

The CHAIRMAN remarked that the clause could not have been put in the Order in the first case, and so bring it within the notice of a private measure, as it was promoted by the Company, not by the Council.

Lord ROBERT CECIL: I hope some very effective precautions will be taken to prevent it being done again; and I hope everybody will let it be known that this Committee is not very favourably impressed with the method.

Mr. COOPER remarked that there was a reporter present from the "JOURNAL," and perhaps an intimation from His Lordship would have the effect of making his opinions known.

The CHAIRMAN: The Speaker's Counsel will watch it very carefully in the future.

Mr. MOON: I have watched it in this case.

Mr. BONNOR MAURICE said he knew of something of the sort in another Irish Order; but he was not aware of it in connection with an English Order.

The clause in the Order was then passed. It authorizes the Council, independently of any other borrowing power, to borrow at interest any sums of money required for the purpose of paying the costs, charges, and expenses payable by them respectively preliminary to, and of, and incidental to, the opposition in Parliament to the Bill promoted by the Tipperary Gas Company in 1910, and to the opposition before the Board of Trade and in Parliament to the present Order

and to the Bill for the confirmation of the present Order. When the Order was considered by Viscount Falkland's Committee, Mr. Vesey Knox asked for a clause on these terms; but the Committee expressed the opinion that only the expenses actually incurred in Parliament should be provided for. The matter was left open for further discussion with the Lord Chairman; and the Council have now got all they asked for.

Clause 14 of the Order, which relates to the continuance of the gas-works, and the sale of residual products, reads as follows:

> The undertakers may, on the lands described in Schedule A to this Order annexed, while they are possessed of the same, maintain and continue, alter, enlarge, extend, improve, renew, or discontinue their existing gas-works and works connected therewith, and may maintain, alter, and enlarge their retorts, gasholders, purifiers, meters, apparatus and works for the manufacture and storing of gas, and of coke, asphaltum, pitch, coal tar, ammoniacal liquor, oil, and residual products obtained in the manufacture of gas, and matters producible therefrom, and they may, subject to the provisions of this Order, make and store gas, and supply and sell the same within the limits of supply, and may on the same lands manufacture and store residual products as aforesaid, and may sell and dispose of the same at their works and elsewhere, and they may also erect, construct, and maintain, alter, enlarge, extend and renew, or discontinue, houses, offices, buildings, and other works connected with the undertaking.

The existing price of gas is 4s. 9d. per 1000 cubic feet; but this has been reduced to 4s. 6d,

Welwyn, Knebworth, and District Order.

This Order was also passed by the Committee. It provides for additional capital to the extent of £6000; and the words "resulting from the manufacture of gas by them" have been inserted in the residuals clause, in order to bring this into what has now come to be regarded as the common form.

LEGAL INTELLIGENCE.

ALLEGED NEGLIGENCE OF A GAS INSPECTOR.

Failure of a Claim against the Manchester Corporation.

In the Court of Appeal on Monday last week, Lords Justices VAUGHAN WILLIAMS, BUCKLEY, and KENNEDY heard an application by the plaintiff in the action of *Forsyth v. Manchester Corporation*, tried before Mr. Justice Bray and a Jury at the Manchester Assizes early this year.*

The proceedings were taken by the plaintiff to recover damages in respect of personal injury sustained by his son—a boy four years old—through the alleged negligence of an inspector in the service of the Manchester Corporation. A prepayment meter in the house of the plaintiff having got out of order in consequence of a coin being jammed in it, he sent a post-card to the Gas Department asking that a man should be sent to remedy the defect. On the 24th of July, a Miss Molloy, who was employed to look after the child, saw a man named Ford, wearing the uniform of the department, passing the house, and called him in to attend to the meter. Ford endeavoured to dislodge the coin by the use of his pocket knife, but could not succeed. He thereupon went to get some proper tools, leaving his open knife in the room. During his absence, the child played with the knife, and ran it into his eye, which had to be removed. It was submitted in support of the plaintiff's case that Ford had been guilty of negligence, and that, as this had occurred in the course of his employment, the Corporation were liable for damages. The defendants contended that in interfering with the meter Ford was not acting within the scope of his authority, inasmuch as he was an inspector of gas-fittings and not a repairer of meters. They also submitted that the accident was not one which could reasonably have been expected as a consequence of the open knife being left in the house. At the trial, the Jury, who had six questions left to them, gave a verdict for the plaintiff, with £125 damages. But after hearing argument on their findings, Mr. Justice Bray ordered judgment to be entered for the defendants, on the ground that there was no evidence either of Ford having acted in the course of his employment or of negligence.

Mr. H. H. SCHLOESSER appeared for the appellant; Mr. J. R. ATKIN, K.C., and Mr. DEHN represented the respondents.

Mr. SCHLOESSER contended that Ford acted in the course of his employment, and had been guilty of negligence; and he therefore submitted that the plaintiff was entitled to judgment.

Lord Justice BUCKLEY said it was admitted that the man was an employee of the Corporation, and one of the issues tried by the Jury was whether he was acting in the course of his employment in doing this particular work.

Lord Justice VAUGHAN WILLIAMS thought that *primâ facie* he was not working for the Corporation.

Mr. SCHLOESSER said the employee was a general gas man—one of a class.

Mr. ATKIN: No; he was an inspector of fittings inside a house.

Mr. SCHLOESSER said the employee was introduced by Miss Molloy to the father as "the gas man."

Lord Justice VAUGHAN WILLIAMS said the main question was whether or not the acts were done by the employee of the Corporation in the course of his employment; and, in his judgment, the evidence was that they were not. There was no evidence whatsoever to the contrary, and none of any fact from which one could draw the inference that it was in the course of his employment, as it was not part of his duty to repair meters.

Mr. SCHLOESSER urged that there was a general duty on the employee to see to the supply of gas in houses.

Lord Justice BUCKLEY pointed out that the evidence proved that this man had no right to touch the meter.

Mr. SCHLOESSER said the Jury had found as a fact that Ford was acting in the course of his employment, and not as a mere voluntary helper. The man admitted that he was "the gas man," and had come to repair the meter; and, after inspecting it, he said that he would report the matter to the Corporation.

Lord Justice BUCKLEY pointed out that the fact that the man had said that his duties were larger than they really were did not make the Corporation liable.

Mr. SCHLOESSER: No; but men were frequently found doing each other's duty.

Lord Justice VAUGHAN WILLIAMS: As I understand the principle in these cases, it is this: If you employ a man to do an act or to carry out an operation, and he fails to obey the instructions given to him, the fact that he fails to do so does not make him less your servant. He is told to carry out something in a particular way, and he does not; but he is not the less acting within the scope of his employment. In this case, it was not a failure on the part of the employee to carry out his instructions properly; but it was not his duty to do what he did. He had been told never to undertake such duty, and he was not acting within the scope of his employment by doing something he was not employed to do. He was merely to be regarded as a volunteer in that particular matter.

Mr. SCHLOESSER urged that the acts of the employee were equally consistent with good nature as with duty.

Lord Justice VAUGHAN WILLIAMS: In my judgment, it is quite plain that the duty of this inspector was to inspect and report; not to repair. There is no question of whether he exercised a discretion which was wrong. As far as he tried to get the penny out with his knife, that was a mere piece of voluntary kindness, and there was no duty at all upon him.

Lords Justices BUCKLEY and KENNEDY concurred; and the application was dismissed, with costs.

* See "JOURNAL," Vol. CXVII., pp. 675, 909.

KENT COUNTY GAS COMPANY, LIMITED.

Preference Shareholders and the Company's Secret Profits.

Last Tuesday, Mr. Justice Neville heard a summons taken out by the Liquidator of the above-named Company; the respondents being the firm of Messrs. S. C. Lawson and Co., the Official Receiver of the estates of Walter S. Darby and Harry Warwick Gyde, and Miss Norris and Mr. Reynolds, the nominees of Messrs. S. C. Lawson and Co. of certain shares. The question for the Court was whether the Liquidator was entitled, in respect of a contribution which he was about to make on the preference shares, to withhold the sums he would have to pay to Miss Norris and Mr. Reynolds by reason of the fact that Messrs. Lawson and Co. were indebted to the Liquidator for £11,000 in respect of secret profits wrongfully made by the firm as promoters of the Company. Mr. Ward Coldridge, for the Liquidator, stated that relief had already been obtained against the separate estate of Darby. That a secret profit was made would not be disputed, nor that Messrs. Lawson and Co. were the promoters of the Company who acquired a gas property for £2000, and, by aid of a nominal Board, sold it to the Company which they promoted for about £20,000, without disclosing on the prospectus or to the Directors the fact of the secret profit. Darby and Gyde had both been sentenced to penal servitude for fraud. He submitted that the Liquidator had a provable debt against the partnership, and a right of set-off against any sums payable. Mr. Cann, for the Official Receiver of the estate of Darby and Gyde, contended that the Liquidator was not entitled to prove against the joint estate, as he had already successfully proved against the separate estate of Darby. The further hearing was adjourned for a week.

Claim for Compensation by a Bradford Gas Worker.

In a claim against the Bradford Corporation by Thomas Grady, a gas worker, for compensation in respect of an injury to his wrist received while employed at the Clayton Gas-Works in October last year, judgment was given last Tuesday by his Honour Judge Graham, K.C., at the Bradford County Court. He said that at the time of the accident the man was receiving £1 14s. 10d. in wages. From this date to June 12 he was paid half wages in compensation, and was then given light work, receiving compensation and small wages to the extent—to take the week ending June 26 as an example—of 20s.; and therefore he had received the maximum compensation. For the applicant it was contended that the 20s. was wages, and that he was entitled to compensation in addition. His Honour said it was quite clear that the light work done by Grady could never have been worth the 20s. He gave judgment against the applicant.

Dissatisfied Gas Consumer at Lisburn.

At the Lisburn Quarter Sessions on the 18th inst., Miss L. Fitzgerald Stannus was sued by the Urban District Council to recover £7 6s. 8d. for gas supplied to her. The amount was for three periods. As the money had not been paid, the gas was cut off on the 11th of July. Miss Stannus admitted receiving the accounts, and said she wrote to the Council complaining of the quality of the gas, which was so bad that she had to use a lamp. One of the defendant's servants said she had to burn a candle for a long time until she obtained a lamp. The gas was very bad in November, and continued so till the spring. Mr. James Allen, the managing foreman at the gas-works, said 14-candle power was the standard quality for the gas, and since his appointment in April it had been more than 16-candle power, with one exception recently, when something went wrong with the coal. There had been very few complaints since he became Manager. His Honour Judge Craig, in giving judgment, said there was a certain charge for gas, and Miss Stannus had consumed the number of cubic feet recorded. Being dissatisfied, she could have had the gas cut off at any time. He made an order for the payment for the full amount claimed. Notice of appeal was given.

MISCELLANEOUS NEWS.

GAS EXHIBITION IN EDINBURGH.

Demonstration of the Forward Policy of the Gas Commissioners.

[From Our Edinburgh Correspondent.]

One result of the forward policy of the Edinburgh and Leith Corporations' Gas Commissioners has been an enormous development of the use of gas appliances, and a commensurate increase in the quantity of gas produced. Indeed, in some respects the undertaking may be said to have become more vitalized; and the fact remains that what has been done is only the beginning of a more extensive crusade for the still further increase in the consumption of gas. Towards this end, the Commissioners have organized in the Waverley Market (which lends itself admirably for such a purpose) an exhibition, in which is on view practically everything in connection with the gas industry—from a working model gas-works down to the latest pattern in silk shades for gas-brackets. Altogether there are 62 stands utilized for the display of the exhibits; and a very fine effect has been produced in the market, which for the time being has been transformed into a veritable "Temple of Light."

Beginning with the outside of the market, a special display is made from 15 columns carrying high-pressure lamps varying in light-giving power from 4500 down to 1500 candles each—the whole illumination provided in this area being 44,000 candles. At the entrances and exits are also placed high-pressure lamps, from 1500 down to 500 candle power each; and the visitor, when approaching the market, gets a splendid illustration of the possibilities of high-pressure lighting under the best of all conditions. Inside the building, the lighting is derived from low and high pressure lamps, ranging from 1500 down to 200 candle power. The lighting is all that can be desired; and the low-pressure lamps under the staircases and corridors are well adapted for their various purposes. The exhibits have been kept to the west end of the building; the eastern portion being devoted to the band-stand, tea-rooms, and lecture hall, where cookery demonstrations and lectures are to be given. One section is reserved for cooking competitions for girls attending the Board Schools. Among the chief exhibits are those by the Gas Commissioners. One is a model house, which admirably demonstrates how very effectively and hygienically gas can be utilized. The Commissioners also show the possibilities of shop-window lighting, and the latest appliances for the economical use of gas for domestic and business purposes. The exhibition is a very representative one in all its departments; and the Gas Engineer and Manager to the Commissioners (Mr. A. Masterton), who has been mainly responsible for arranging all the preliminary details, has secured a display which is unique in the history of the gas undertaking in the city, and emphasizes the fact, if it were required, that the policy of the Commissioners is based on the right principles.

Inaugural Dinner.

The exhibition, of which Mr. J. H. Freer is the Manager, was opened on Wednesday last, and it will remain open until next Saturday. On Tuesday evening, there was a private Press view, and dinner was served in the Commissioners' offices, Waterloo Place—Lord Provost Sir W. S. Brown presiding over a Company which included Mr. W. R. Herring, M.Inst.C.E., the Consulting Engineer to the Commissioners, and Mr. Alex. Wilson, the Gas Engineer and Manager to the Corporation of Glasgow. A number of speeches were made, in which the development of the gas undertaking in the city and the possibilities of gas in the future were referred to.

The Lord Provost mentioned that it was 24 years since the Commissioners acquired the gas undertaking in Edinburgh and Leith. At that time electric light was assuming a practical form as an illuminating agent for streets and dwellings; and many people prophesied that the days of gas were numbered. However, the result had proved the reverse. As showing the great strides made by the Gas Department, he mentioned that the output of gas at the time of the acquisition of the undertakings was about 1273 million cubic feet per annum, whereas it had now increased to nearly 2000 millions; and the price had been gradually reduced from 4s. 6d. per 1000 cubic feet, which figure it reached in 1893, to the current rate of 2s. 8d. to ordinary consumers in the city, and 2s. 3d. for power and trade purposes—the lowest price yet attained. Had it not been for the recent rise in the price of coal and labour, the Commissioners would have been able to lower it still further. They had felt for a considerable period that, owing to the great advance made in the manufacture and application of apparatus for using gas for lighting, heating, cooking, power, and industrial purposes, it devolved upon them to bring these appliances before the people who would derive benefit from their use; and, after long and serious consideration, it was decided that this idea could best be carried out by means of a public exhibition. He believed he could fairly claim to have set the wheels in motion by means of a proposal made as far back as the autumn of last year that the Engineer and the Treasurer and Collector should submit independent reports as to the progress of the undertaking, and how the utilization of gas could be stimulated. The outcome was, among other things, that the Commissioners decided to offer cooking and domestic appliances free on loan to consumers, and to fit them up without charge; also to let on hire, at moderate rentals, heating appliances, such as gas-fires, radiators, &c.—likewise fitting them up free. Further, to reduce the price of gas used for power and industrial purposes by abolishing meter-rents, and to lower the price of gas to consumers who took gas on the prepayment meter system. Again, in order to enable the public to become aware of these concessions, and to give them an opportunity of seeing the various appliances and becoming acquainted with their utilization, the exhibition which they were to open next day had been organized. He would not expatiate on the many advantages and economies which would be derived from the adoption of the various devices, but he felt sure that many of those present would be greatly surprised at the advances which had been made in almost every channel.

At the request of the Lord Provost, Mr. Masterton explained in detail the principal features of the exhibition in the matter of light, power, cooking, and heating. He remarked upon the representative nature of the display, and concurred with the Lord Provost in the remark that greater scope would yet be forthcoming from the enhanced use of gas appliances.

Mr. Alex. Wilson said he always had unbounded faith in gas. In his opinion, the gas business was still quite young, as they were only beginning to realize what could be done with it. The trouble in the past had been that they had been too modest, and had not let the public know what they could do for them. Aided by the manufacturers, however, they were now going forward by leaps and bounds, and giving a service for light, heat, and power in a way that could not be touched by anything he knew of at the present time. In Glasgow, they had put in about 50,000 cooking-stoves since the 30th of April; while during the run of their exhibition they received orders for 3000 gas appliances. There was an unlimited field for them to work upon. Having argued that any hygienic objection which could be taken to the use of gas in old days did not obtain now, Mr. Wilson commended the efforts that were being made in various towns to enlist the services of the doctors in educating the public. He concluded by expressing his good wishes for the success of the exhibition, and by proposing "The Exhibition Committee."

Bailie Lindsay, in reply, stated that up to the 15th of May there were only 9500 cookers out, which was about 10 per cent. of the number of gas consumers. As a result of their forward policy, they had since then added 3500 cookers, and given out 1500 grillers and 1000 hot-plates. The consumption of gas this year showed an increase of 7 or 8 per cent.

Mr. W. R. Herring remarked that the duty of the Commissioners was to manufacture gas, and sell it to the community at cost price. They made no profit and received no dividend. It might therefore be asked why they should endeavour to increase the consumption. One would almost think that their duty would be to persuade the consumer to use as little as possible. But in their endeavour to sell more gas they were anxious not to increase the quantity which the consumer used for his present purposes; on the contrary, they were endeavouring to reduce the quantity. They were, however, in the unfortunate position that by encouraging economy they had reduced their output; and in doing this they had increased their oncosts. The only way to produce further economies was not only to recover this loss of output, but to increase the consumption of gas in other directions. So that their whole effort was to open-up untouched fields for the use of gas; and there were many such fields where gas could be employed with considerable advantage to the consumers. Having emphasized the need for an increased day consumption, Mr. Herring said that their present efforts were directed to the use of gas hygienically. They would also reduce the labour in the household; and by encouraging the utitilization of gas for trade purposes they hoped to see great development of small trades in the locality.

Opening Ceremony.

There was a representative company present at the opening of the exhibition on Wednesday, when the Lord Provost performed the ceremony. In the course of a brief address, his Lordship alluded to the value of the exhibition, and expressed the hope that the utilization of gas would be stimulated by it. He also alluded to the various means which had been provided to illustrate the economical and cleanly use of gas. Bailie Lindsay (Leith), when proposing a vote of thanks to the Lord Provost, mentioned that the increase in the consumption of gas this year had been from 7 to 8 per cent., as compared with last year's total.

During the week, the attendance of the public has been very large; and the cookery demonstrations by Miss Dods and Mrs. Gray, and lectures by Mr. O'Connor, have been also closely and appreciatively followed.

DANISH GAS COMPANY.

Gas Consumption of Lost Stations Nearly Recovered—A Strong Financial Position.

The Annual General Meeting of the Company was held last Thursday, at Millbank House, Westminster, S.W.—Mr. Corbet Woodall in the chair.

The London Agent (Mr. H. G. Warren) read the notice convening the meeting; and the Directors' report [*ante*, p. 306] and the statement of accounts were taken as read.

The Chairman said it was his very pleasant duty to move that the report and accounts be received and adopted. In doing so, he thought he might anticipate that they would be regarded as satisfactory and, in some respects, remarkable. Last year, the profits shown included a half-year's returns from the town of Aalborg. The current year had no return at all from Aalborg; yet the profit the Directors were able to show had increased upon that of the preceding year. The quantity of gas sold in Aalborg and Randers—the two towns the Company had lost since 1909—represented about 15½ per cent. of the total sales of gas at that time. The less quantity of gas that they had actually issued in the past year had been 5½ per cent. of that sold in 1909; the balance having been made up by the growth in the towns remaining to the Company. He had no doubt whatever that in the current year they would recover the remainder of the loss, and turn the deficiency into gain. The report told the shareholders that the net revenue for the year was £77,481, or £6037 more than that of the previous year. Of the items contributing to this gain, the chief were: First, the higher price under the sliding-scale for the gas sold. The shareholders would remember that the municipal contracts included a standard price for coal and a standard price for gas. When the market value of coal rose, the price of gas increased also at a rate intended

to adjust the one to the other. The date when the market value was determined did not always agree with that when the contracts were made. Hence the Company were sometimes charging more, and sometimes less, than the contract price dictated. In the past few months, the scale had given them higher prices. Later on, when the price of coal came down to a more reasonable figure, the consumer would get the benefit. So equity would be maintained. In the second place, there had been an increase in the quantity of gas sold. The actual quantity sold was less if they included Aalborg. Allowing for the loss of Aalborg, the stations showed a gain of 40 million cubic feet, representing in revenue £8000. Thirdly, there had been a great improvement in the receipts for residuals. The selling price of coke was higher by nearly 19 per cent.; tar was better by 30 per cent.; and ammonia by about 10 per cent. Against these gains they had excess expenditure upon coal and oil, £3700; wages, £1700; renewals and repairs, £4900; general charges, including income-tax, £1570; and contributions to towns, chiefly Flensburg, £6240. Further, there was the loss of the Aalborg profits for the half year, amounting to £6957. Bringing these items together, they had gains totalling to £31,164, and higher costs and expenses £25,127, or a net gain of £6037. The year's expenditure on capital account was £19,032. Of this, £11,828 was for new buildings and plant, chiefly at Flensburg and Horsholm; £2500 for land; and the remainder for mains and distribution charges generally. The Board had bought and cancelled altogether £17,640 of debentures, of which £6160 was purchased within the account year, and £3810 since June 30 last. Of share capital they had purchased and added to the investments 494 preference shares and 474 ordinary shares, of a value together of £12,050. The value of those included in the account year was £7381. The net result of the year's operations was as follows: They had carried to the redemption fund sums which total to £22,263. Against this, they had charged £2000 for reduced value of outside investments, and £863 balance of expenses of winding-up affairs in Aalborg. The net addition to the funds was thus £19,400. They were able to recommend the same dividend and bonus as last year, to relieve the shareholders of the burden of income-tax upon the final dividend, and to carry forward £8496 more than they brought into the account. British income-tax had never been charged against Danish shareholders; and they were now able to put the home proprietors into the same position. The general outlook might be regarded as satisfactory. The contract with the town of Flensburg had been extended by a further term of ten years. To secure this, large concessions had had to be made, which were affecting the profit income rather seriously. The Commune of Gjentofte made some overtures to the Board early this year in the direction of acquiring the undertaking in their district. They had the right to purchase in 1913, but they had not proceeded with negotiations. He might say that Mr. Gardiner and himself interviewed a Committee of the Commune at Gjentofte; and after discussing matters, they had allowed the matter to drop. The right revived at the end of each quinquennium; and the Directors were proposing to the Communal Council to re-arrange the contract so as to enlarge these periods—of course, in exchange for concessions on the Company's part. It would be clear to the shareholders that the determination of the scale of extensions was rendered difficult when the fixed tenure was so short—a period of only five years. At Odense, the contract matured in 1915. The Board were, however, hopeful that they would be able to satisfy the Municipality that it would be to the interest of the town to extend their relations with them. Adjoining Odense was a rising district called St. Hans, having a present population of 5000 persons. This was under separate communal control; and they had entered into a contract to supply the inhabitants with gas for a period of thirty years. Land had been purchased for the erection of gas-works specially for St. Hans; but for the present the Directors hoped to supply from the mains in Odense. He was glad to say that their relations with the municipal authorities in all the towns they supplied were satisfactory—he thought he might say, friendly. There seemed, however, to be a growing feeling that public services like the supply of gas or water should be in the hands of the community; and where this obtained, the difficulty of renewing contracts was great—in fact, as they found at Aalborg, insuperable. The position, financial and otherwise, of the Company was, however, strong; and he hoped they would be able to keep the flag flying for many years yet to come. The staff in Denmark was very busy just now with works of extension and improvement, which would, he expected, yield a good return in still better manufacturing results, as well as in larger revenue. With these observations, he proposed that the report and accounts be received and adopted.

Lieut.-Col. C. M. DAVIDSON seconded the motion.

Mr. A. BAIRD said he was glad to take the opportunity of congratulating the Board on the excellent and most satisfactory report and balance-sheet which had been laid before the shareholders, and at the same time to thank the Chairman for the interesting and instructive remarks he had made on this occasion, as he always did at their annual meetings. He thought it was gratifying indeed when they considered the coal strike and the state generally of the industrial market in this country during last year, that they had not affected the profits so much in Denmark as they might have done in this country. When it was considered that they had lost Aalborg as well as Randers, it was very pleasing and satisfactory to find the profits for 1911-12 were very nearly 10 per cent. above those for the preceding year, which happened to be larger than any year before. Those present at last year's meeting were extremely pleased to hear the Chairman hold out the hope that the profits would be sufficient to allow the dividends to be paid without deduction of income-tax. Those who knew their Chairman were perfectly satisfied that, barring unforeseen contingencies, that hope was certain to be fulfilled. On the part of the shareholders, he could assure the Directors that no more satisfactory method of dealing with the extra profits could have been carried out than this. He noticed a small cancellation of debentures since last year; and he hoped that this would be continued in future years. He also observed that the investment of the Company in its own shares remained the same as last year. But he ventured to say that he trusted this item would be dealt with, because he thought, in the interests of sound finance, it would be more satisfactory if the amount was placed in a security entirely outside the Company's business. He had on previous occasions made some observations upon the reserve fund and investment. He still thought it would be a wiser plan if a part at least of the £15,000 which was being placed to the reserve fund had been invested altogether outside the Company's business, because he felt sure the small loss of interest that might accrue from an operation of this sort, would be more than compensated by the increase it would give to the financial strength of the Company. The Chairman had very kindly informed him on previous occasions that his (Mr. Baird's) views on this subject had received the careful consideration of the Board. He could only hope that, in the next balance-sheet, it might be found that his views had the Board's approval.

The CHAIRMAN said he had just a word or two to say in reply to Mr. Baird's kind and valued criticisms. The Board had considered very carefully the disposal of the amount invested in their shares; and they had decided again only that day, after reconsidering the matter, that, instead of cancelling the shares, they should continue to hold them as part of their investment—first, on the ground that they know of no better or more profitable investment, and, furthermore, because there was the possibility, in the whirligig of events, they might want some more capital, in which case they could re-issue these shares, whereas, if they cancelled them, they would have to create a new issue of shares, which would be very troublesome. Mr. Baird would forgive him (the Chairman) reminding him that they had that day written off another £2000, because of the depreciation of the value of outside securities, whereas the money they had invested in their own Company had appreciated—not largely, but still it had appreciated. He could not say, bearing in mind the high estimate they placed upon Mr. Baird's opinion and the value they put on his approval of the operations of the Company, how much they desired to follow his advice in this matter. The Board would again consider whether or not, out of the large sum there was lying at their bankers, they should not put some more to outside investments, if Mr. Baird would point out some investments that were not likely to depreciate. [Laughter.]

The motion was unanimously carried.

Mr. R. S. GARDINER moved, and Mr. M. M. BIDDER seconded, a resolution declaring a final dividend for the year ending June 30 last of 2½ per cent. on the preference shares, 5 per cent. on the ordinary shares, and a bonus of 1 per cent. on the ordinary shares, free of income-tax.

On the proposition of the CHAIRMAN, seconded by Mr. GARDINER, Lieut.-Col. Davidson was re-elected a member of the Board.

Mr. BAIRD proposed, and Mr. RICHARDS seconded, the re-appointment as Auditors of Mr. Edwin Waterhouse, F.C.A., and Major E. A. Critchley.

Moved by Mr. H. G. L. DAVIDSON, and seconded by Mr. WARING, the Chairman and Directors, the Secretary, and the staff in England and Denmark, were heartily thanked for the work they had done during the past year. Mr. Davidson remarked that the shareholders realized fully the difficulties that all gas companies, including the Danish, had gone through during the year, owing to the terrible coal strike.

The CHAIRMAN, on behalf of his colleagues and himself, the officers, and the staff generally, thanked the shareholders very much for this vote. Their service to the Danish Company, he said, was a very pleasant one; and to these annual meetings they always looked forward with interest and pleasure, because they knew the shareholders all approved of the way the work was done—realizing, as they did, that it had been done as well as the Board and officers knew how to do it.

CEARÁ GAS COMPANY, LIMITED.

An Increased Dividend.

The Annual General Meeting of this Company was held last Friday, at the London Offices, No. 9, Queen Street Place, E.C.—Mr. F. A. WALLROTH in the chair.

The SECRETARY (Mr. E. Pratt) read the notice convening the meeting and the certificate of the Auditor; and the report and accounts were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said he thought the shareholders would agree with the Board that they were satisfactory. The amount of profit was not so great as that of the previous year; but there were one or two exceptional circumstances that arose which had affected the Company. Last January, the city was in a state of riot for two or three days, which resulted in the deposition of the President of the Province; and in the uprising that took place, the Company's lamps were smashed in many places. Their Engineer (Mr. Reid) had the value of the damage done estimated by the authorities; and it appeared that the amount totalled about £1700. This sum the Board had claimed from the State; and as the matter was what might be termed *sub judice* at the moment, he would not enter any further into it. The second untoward circumstance was the coal strike that took place in this country. It was impossible to obtain coal here; and, of course, shipping was much affected as well. The Board were able to keep up their supply of coal by getting it from the United States; but this had added a good deal to the cost. Turning to the accounts, and taking first the balance-sheet, it would be seen that the debentures stood at £5000 more, while creditors were about £1000 less. On the credit side, the expenditure on new works amounted to £26,445 to date. They had now nearly completed the works that were necessary to be carried out on account of the extension of the concession. The Directors undertook to replace all the old lamps with incandescent lights; and this was to be done within three years of the signing of the concession. The Board had been anxious to push on with this work; and from the last advices received from Mr. Reid, he was glad to be able to inform the shareholders that it was nearly completed—there being only about fifty lamps still to be placed in position. Thus the Company were quite a year in advance of their undertaking. The new gasholder had been erected; and the various other things they had to do in the works were being completed. The amount due for gas, fittings, &c., was £698

more, stocks were £2754 more, and goods in transit £600 less. Investments remained the same; and cash and bills were £8000 less. Coming to the profit and loss account, coals carbonized cost £2000 more. In the previous year there was an exceptional cause for the cost being so low, and this year the coal strike, to which he had already referred, affected them. The item of manufacture was £400 more, repairs were much the same, salaries had advanced £500; while rent and taxes were a little less, and bad debts £500 less. General charges remained much the same, interest on debentures was £550 more, and exchange was £643 less. Since the end of the year, the Board had, as the shareholders knew, issued the remaining £10,000 of debentures, so that now there was £25,000 of debentures outstanding. The new issue was over-applied for, and it was impossible to give the shareholders all they wanted. On the other side, gas supplied figured at a little less than on the previous occasion. This decrease might, he thought, be accounted for as arising from the new law compelling all the shops in the district to shut at a certain hour. The item of products, fittings, &c., was a little more. The result was that a profit was shown of £7674; and the Directors proposed, after paying the usual preference dividend, to declare a dividend of 10 per cent. for the year on the ordinary shares. This was 1 per cent. more than was paid for the preceding year; and he felt sure the shareholders would deem the dividend satisfactory. There was one other matter to which he would like briefly to allude, and that was the subject of increasing the remuneration of the Directors. The fees had remained the same for over thirty years, though, of course, during this time the work had greatly increased; and the Board thought that the present was a fitting time for a change to be made. He was sure he need only remind the shareholders that his colleagues were men of great experience and ability, and that there was never the slightest hesitation on their part in giving their time ungrudgingly to the conduct of the affairs of the Company.

Mr. F. W. BROTHERS seconded the resolution.

The CHAIRMAN, in reply to a question by Mr. R. M. LONG, said the damaged lamps had all been put in order again, and part of the expense incurred in the matter appeared in the present accounts. They had not yet been paid their claim. If they had had a settlement, the accounts would show an even more satisfactory state of affairs than that at present exhibited.

The motion was then carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. T. M'MAKING, a dividend was declared for the six months of 5 per cent. on the preference shares (less income-tax) and of 7 per cent. on the ordinary shares (tax free), making, with the interim dividend already paid, 10 per cent. on the preference shares and 10 per cent. on the ordinary shares for the year.

The retiring Directors (Mr. Wallroth and Mr. Thomas Guyatt) were then re-elected, on the proposition of Mr. BROTHERS, seconded by Mr. F. E. LINGING; and the Auditor (Mr. A. W. Cooper) was re-appointed, on the motion of Mr. T. A. GUYATT, seconded by Mr. T. P. FISHER. His fee was increased to £15 15s. for the past year, free of tax.

Mr. CHARLES WEBB proposed that the remuneration of the Directors be fixed at £800 per annum, free of income-tax, and that the sum of £400 be taken from the balance carried forward as extra remuneration for their services during the past year. As the shareholders were well aware, he remarked, the Directors had had considerable work during the last two or three years in connection with the extension of the concession, which was a most valuable asset; and the Board, and all those who had had the matter in hand, were to be congratulated on what had been accomplished. The Directors of the Company were men who thoroughly understood the manufacture of gas.

Mr. LONG seconded the proposition, which was at once agreed to; and the CHAIRMAN on behalf of himself and his colleagues thanked the shareholders for this mark of their appreciation of services rendered.

Proposed by Mr. WEBB, and seconded by Mr. FISHER, a hearty vote of thanks was then accorded to the Chairman and Directors.

The CHAIRMAN, after acknowledging the compliment, proposed a similar vote to the Engineer and staff in Ceará and London. He pointed out that Mr. Pratt had been elected to the post of Secretary, and had thrown himself with great zeal into the work. As regarded Ceará, it was a pleasure to him to testify to the excellent manner in which Mr. Reid was conducting the affairs of the Company out there. At the time of the riots, he was able to get protection for the works; but, of course, the state of affairs that existed at the time was very trying—especially as he was very busy with the extensions. In spite of all, however, Mr. Reid had carried out the work with the same energy that he had shown right through. As to the incandescent lighting, they were, as a matter of fact, really about seventeen months in advance of their contract in putting up the new lamps; and this had given great pleasure to the authorities.

Mr. M'MAKING seconded the vote, and it was cordially passed.

COST OF PUBLIC LIGHTING AT WREXHAM.

Gas and Electricity Compared.

The Institution of Municipal and County Engineers held a meeting at Wrexham on the 19th inst., at which Mr. J. England, the Borough Engineer, read a paper on the public works of the town.

The street lighting is by both gas and electricity; the total number of lamps being 375, and the cost £1936. The whole of the gas-lamps are fitted with incandescent burners; and the average cost per lamp with 5-feet burners, including renewals and cleaning, is £2 11s. 3d. per annum—the lighting hours being 3345, and gas costing 2s. per 1000 cubic feet. The electric lighting is by means of 45 high candle power metallic filament lamps of 600 watts in the principal streets, each costing £20 per annum; the smaller lamps being fitted with metallic filament lamps, averaging 75-candle power, and the cost per lamp being £3 3s. Automatic switches have been fitted to twenty of the gas-lamps as an experiment, and up to the present have been found very reliable; and it is hoped to extend the system to the whole of the lamps on the outskirts of the town in the near future.

In the course of the discussion on the paper, Mr. T. W. A. Hayward, of Battersea, remarked that the figure of £1936 for 3345 lighting hours appeared to be very high for a town of the size of Wrexham; and one could not but notice the difference in the cost of lamps where gas was the illuminant compared with those supplied with electricity. The price of metallic filament lamps of high candle power was undoubtedly excessive. Automatic switches for gas-lamps had been working in Battersea for several years, and had given every satisfaction.

RETFORD GAS AND WATER UNDERTAKINGS.

The Past Year's Working.

Reports relating to the gas and water undertakings of the Retford Corporation for the year ended June 30 have just been issued. The gross profit of the gas undertaking is £3470, compared with £2408 in the previous year. This is an increase of £1062, and is the largest profit made for many years. The net profit is £2120, compared with £991 before—an increase of £1129. This is accounted for by reduced expenditure and a greater yield of gas and residuals from the coal carbonized. The Committee report that the demand for gas on the prepayment system increases. In regard to the water undertaking, the Committee report that the amount now standing to the credit of the profit and loss account is £968. The water-rates come to £3107, compared with £3046 for the preceding year. This is considered satisfactory, as since Dec. 30, 1910, all charges for water supplied to domestic baths have been abolished. The net profit is £886—showing an increase of £57.

PRICE OF GAS AT MANCHESTER.

The Chief Gas Engineer Advocates Cheaper Rates.

Mr. J. G. Newbigging, M.Inst.C.E., the Chief Gas Engineer to the Manchester Corporation, in an address delivered recently to the members of the Openshaw Brotherhood, Manchester, referred to the subject of the price of gas and the desirability of selling it as cheaply as possible in the general interests of the community.

At the outset, he said that, notwithstanding the remarkable development of electricity since its first introduction to Manchester in 1893, the output of gas had increased by no less than 56 per cent. This showed that there was plenty of room for both gas and electricity. The rate of expansion in the future depended very much upon the price at which gas was sold, and therefore it behoved all connected with the administration of gas undertakings to take every advantage of the economical methods of manufacture and distribution. His own opinion was that the price of gas was altogether too high in most of our large cities and towns, in many cases possibly through circumstances over which the suppliers had no control, but in others through neglect of reforms in the general working of their undertakings. It had, of course, to be remembered that until 25 years ago gas had almost a monopoly in the field of lighting; but since electricity became a practical and commercial success, the gas industry had to be satisfied to share with its competitor the lighting of homes, public buildings, and streets. There was, however, a field for gas which electricity could not touch, either in price or efficiency, and that was for cooking, heating, and many industrial purposes. Seven cubic feet of gas, as against one unit of electricity, produced 3500 units of heat. At 2s. per 1000 cubic feet, 7 cubic feet of gas cost one-sixth of a penny. In order to compete with gas at this price, electricity would have to be sold at one-sixth of a penny per unit; and this was at present impossible, even by the excellently managed electricity undertaking of the Manchester Corporation. As a substitute for smoky solid fuel, gaseous fuel was pre-eminent; but they could not hope for its general adoption unless it was considerably reduced in price. Municipalities owning gas-works had a most efficient weapon for fighting the smoke fiend; and it was his earnest hope that the Manchester Corporation would take the lead in making it possible for every citizen to avail himself of an abundant supply of cheap gaseous fuel, and thus make the city an ideal place in which to live.

Gas Collectors Oppose the Discount System.

The suggested introduction of the discount system in the Manchester Corporation Gas Department has been considered by the collectors, at the invitation of Mr. W. Kay, the Chairman of the Gas Committee. As a result, they have placed before the Committee a long statement setting forth their views of the proposal. As to the arguments that the discount system is general, and would tend to more economic working, by reducing the cost of collection, it is submitted that "the inquiries upon the results of which this is based can only have covered a very limited area of the gas industry, as it can be proved beyond question that, reckoning all the undertakings in the country, a scrutiny of the official returns shows that the non-discount authorities outnumber by two to one those in which discount is given for early payment. A further analysis reveals the fact that, whether corporations are considered apart from private companies, or whether the undertakings are dealt with according to locality, the prompt-payment discounts are in a great minority." Then on the second point the collectors say that a discount of 5 per cent. would deplete the revenue of the department to the extent of approximately £20,000, while a saving of the cost of half the present staff would be £3710—showing a net revenue loss of £16,290 per annum. "This," it is added, "cannot be rightly defended in the interests of economy. This comparison takes no account of the necessarily increased cost of additional office accommodation, and the cost of branch receiving stations. Moreover, there would inevitably be a resulting increase of bad debts, as a reduced staff of collectors would not be in such close touch with consumers as at present. In this connection, the following figures will show the favourable position of Manchester as compared with towns where discounts are given, and the equivalent saving to the city through the low percentage of bad

debts: Bad debts per £100—Manchester, 2s. 7d.; Leeds, 8s.; Bradford, 14s.; and Newcastle, 12s."

Attention is called to the fact that in Manchester the gas collectors are also responsible for the collection of the electricity rentals; and the collectors think a percentage of bad debts on the joint rentals of only 2s. 7d. per £100 must be regarded by the Committee as very satisfactory. The rental for 1911 was: Gas, £494,696; electricity, £277,052—total, £771,748. The cost of collectors' salaries only amounted to 22s. 9d. per £100 of rentals; and, in view of the efficiency obtained, the collectors say this cannot be justly regarded as excessive. It is pointed out that the cost per collector for the collection of the gas accounts has decreased very considerably. In 1890, the average was £250; in 1900, £224; and 1911, £177. This reduction was effected though the combined reserve has more than doubled in the period noted—*i.e.*, from £360,532 to £771,748. This great saving to the Committee is owing to the retirement of senior collectors and the appointment of others at smaller maxima; and it is also due to the contribution of the Electricity Committee increasing annually for the collection of their accounts, which accordingly diminishes the cost of collecting the gas accounts.

INCREASED STORAGE AT THE GIRVAN GAS-WORKS.

Inauguration of a New Gasholder.

The development of the gas-works at the Ayrshire seaside town of Girvan reached a further stage on the 16th inst., when a new spiral-guided gasholder was formally inaugurated. It is 60 feet diameter and 18 feet deep, is constructed of steel plates, and works in a tank measuring 63 feet diameter and 18 ft. 6 in. deep, and resting on a foundation of solid concrete 65 feet diameter and 18 inches thick—the whole being practically on the ground level. The holder has a capacity of 50,000 feet, and is arranged to be fitted with additional lifts, should increased storage be required, to bring it up to 100,000 cubic feet. The steel work was carried out by Messrs. Robert Dempster and Sons, Limited, to specifications by Messrs. W. & C. Fairweather, gas engineers, of Kilmarnock. The whole cost has been about £2300. The work was commenced at the beginning of May, and the expeditious nature of its execution is evidenced by the fact that the Company were able to put gas into the new holder on the 20th of September.

The ceremony of turning the gas from the holder into the mains was performed by Mr. W. Shankland, the Chairman of the Company, in the presence of a numerous assembly, which included Directors and officials, representatives of the engineers and firms connected with the contract, and gas managers from various towns. Mr. Shankland gave an interesting sketch of the progress of the Company from the issue of the prospectus in 1840. The original capital was £1250, and the maximum holding 20 shares. For a long time the make of gas was less than 3 million cubic feet per annum. When he joined the Board in 1886, the capital stood at £3096. He paid a tribute to their former Chairman (Mr. John Lawson), and also to Mr. Fairweather, their Consulting Engineer, whom they appointed in 1891, when several improvements were made at the works. The consumption of gas increased, and the price was reduced from 5s., at which it had stood for a long time, to 3s. 9d. per 1000 cubic feet. In 1906, a great forward movement took place. The annual make of gas was 9 million cubic feet, and only 6¾ millions were sold; showing a loss of 25 per cent., which clearly proved that the plant was quite unfit to cope with the requirements of the town. A new Manager was appointed in the person of Mr. Thomas Watson, and the Company was converted into a limited liability one. The result was that three years afterwards Mr. Watson was able to report an increased sale of 3,346,000 cubic feet, and a reduction in leakage from 25 to 16 per cent.; while at the end of the last financial year there was a further increase of 3,900,000 cubic feet, and the leakage was reduced to 10 per cent. Mr. Shankland concluded by declaring the new holder in full working order, and expressed the hope that it would long continue to give out gas to the mutual benefit of the shareholders and of the inhabitants of Girvan.

At the conclusion of the ceremony, Mr. J. W. Broadhead, representing Messrs. Dempster, presented Mr. Shankland with a souvenir of the occasion in the shape of a handsome silver rose-bowl, bearing the following inscription: "Presented to Wm. Shankland, Esq., Chairman of the Girvan Gas Co., Ltd., on the occasion of the opening of the new gasholder on 16th October, 1912." In accepting the gift, Mr. Shankland said it would not only rank as a souvenir of the opening of the holder, but also of his silver wedding, which Mrs. Shankland and he had recently celebrated.

The company were subsequently entertained at dinner by Messrs. Dempster—Mr. Shankland presiding. The toast of "Success to the Girvan Gas Company" was proposed by ex-Bailie Smellie, and acknowledged by the Chairman. Ex-Provost M'Creath, in proposing "The Contractors," mentioned that the firm of Messrs. Robert Dempster and Sons had been founded by a Scotsman. He paid a high tribute to the work of the firm, as exemplified by the new gasholder just brought into use, and referred in complimentary terms to the share taken in the work by Messrs. Campbell. Mr. Broadhead, in reply, corroborated the statement as to the founder of his firm, gave some interesting particulars of their contracts, and expressed his thanks for the help afforded by Messrs. Fairweather and Mr. Watson in connection with the one just completed. Mr. Charles Fairweather acknowledged the toast of "The Engineers," and Mr. Watson that of "The Officials of the Gas Company."

The Parkinson Stove Company, Limited, of Birmingham, forward copies of two of their new season's gas-heating booklets. One gives in concise form illustrated particulars of their numerous patterns of gas-fires; while the other is similarly devoted to gas-heated steam-radiators.

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NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Auchterderran.—At a special meeting of the shareholders of the Cardenden Gas Company, Limited, on Wednesday, presided over by Mr. R. S. Ramsay, it was resolved that 2000 shares of £1 each (part of the Company's unissued capital, 11,500 shares) should be offered, in the first instance, at a premium of 1s. per share, to such persons resident in or about the village of Kinglassie (Fife), as the Directors may choose, and that the Directors be empowered to dispose of any shares not taken in response to such offer as they consider expedient in the interests of the Company. The extension of gas to Kinglassie has been long contemplated; and this resolution now enables the Directors to carry out the scheme.

Edinburgh.—At Thursday's meeting of the Parks Committee of the Town Council, consideration was given to the Lord Provost's motion as to the improvement of the Calton Hill and its approaches. At the last meeting, it was agreed to obtain an estimate for the lighting of the hill by electricity in addition to the estimate which was before the Committee for lighting by ordinary gas. It was resolved, after witnessing the effect of the high-pressure gas lighting at the exhibition, to obtain an estimate of the cost of lighting by this system.

Lochee.—Last Friday, two young mill workers, John Adams and Hugh Prophet, both of Lochee, broke into a house there and took 4s. 11d. from a gas-meter. Encouraged by their success, they entered another house, and secured 6s. 3d. At Dundee, on Thursday, they admitted the offence, and Prophet, who had been previously convicted for house-breaking, was placed by Sheriff Neish on probation for three months; Adams being admonished.

Tayport.—Sheriff Armour Hannay, at Cupar, on Thursday, gave his judgment in the actions against the Tayport Town Council by Mrs. E. MacWalter, or Feathers, of Tayport, and her servant—each of whom sued the Town Council for £50 in respect of injuries sustained by them through an escape of gas—and awarded them £10 each, with expenses on the lower scale. In his judgment, Sheriff Hannay finds that the pursuers were found insensible in Mrs. Feathers' house on Jan. 19, 1912, owing to an escape of gas from the meter; that the meter was a wet one forty or fifty years old, and had not been overhauled since 1895; that the float inlet-valve had jammed and would not close; that the accident was due to the fault or negligence of the defenders or their servants in not keeping the meter properly watered, and in not examining this old meter to see that the valve was in order.

On an application from the Westbourne (Sussex) Parish Council, the Chichester Corporation have assented to lay water-pipes to Bosham, on a guaranteed return of 10 per cent. per annum for ten years.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 26.

Sulphate of Ammonia.

Throughout the week the market for this material has continued to have a drooping tendency, and once more a further reduction in prices has to be recorded at all the ports. The output from gas-works is now increasing, and the present supply seems to be rather in excess of the demand. At the close, the nearest values are: £13 18s. 9d. per ton f.o.b. Hull, £14 per ton f.o.b. Liverpool, and £14 1s. 3d. per ton f.o.b. Leith. In the forward position, manufacturers have modified their views to a certain extent, but their ideas are still too high to permit of first-hand transactions in competition with speculative sellers.

Nitrate of Soda.

The tone of this market remains very firm, and quotations are repeated at 11s. 7½d. per cwt. for ordinary and 11s. 9d. for refined quality on spot.

LONDON, *Oct.* 28.

Tar Products.

There is little alteration in the market for tar products. Pitch remains in about the same position, though it is rather difficult to do business even at the present quotations. Benzols are fairly steady, though sales are reported for next year at lower prices. Solvent naphtha is steady; but there is not very much fresh business. Heavy naphthas are firm and in good demand. Creosote maintains its price; and there is a regular inquiry for near and forward delivery. Crude carbolic is unchanged.

The average values during the week were: Tar, 27s. 9d. to 31s. 9d. Pitch, London, 45s. to 46s.; east coast, 45s. to 45s. 6d.; west coast, Clyde, 46s. to 47s.; Manchester, 44s. 6d. to 45s.; Liverpool, 44s. 6d. to 45s. 6d. Benzol, 90 per cent., naked, London, 11½d.; North, 10½d. to 10¾d.; 50-90 per cent., naked, London, 11d.; North, 10½d. to 11d. Toluol, naked, London, 11½d. to 1s.; North, 11d. to 11½d. Crude naphtha, in bulk, London, 5½d. to 5¾d.; North, 5d. to 5½d. Solvent naphtha, naked, London and North, 1s. 1½d. to 1s. 2d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. f.o.b.; North, 10½d. to 11d. f.o.b. Creosote, in bulk, London, from 3½d. to 3¾d.; North, 3d. to 3¼d. Heavy oils, in bulk, 3⅜d. to 3½d. Carbolic acid, casks included, 60 per cent., east coast, 1s. 11d. to 2s.; west coast, 1s. 10½d. to 1s. 11d. Naphthalene, £5 to £9; salts, 45s. to 55s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

There is still very little business doing in this article at the present moment; and the tender parcels which have come into the market during the week have not realized top prices. A great many makers appear to have some quantity to offer for near delivery. London makes are quoted at £13 7s. 6d. Hull is £14; Liverpool, £14 1s. 3d. to £14 2s. 6d; Leith, £14 2s. 6d. to £14 3s. 9d.; Middlesbrough, £14 to £14 1s. 3d.

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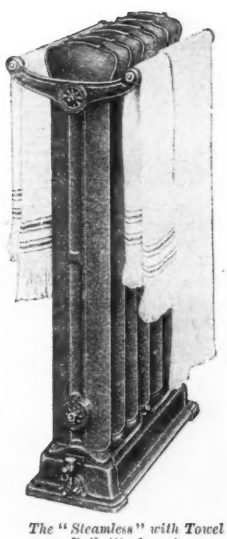

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COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade of the North has shown increased strength for most kinds. In steam coals, best Northumbrians are from 13s. 9d. to 14s. 6d. per ton f.o.b.; second-class steams are from 11s. 9d. to 12s. 3d.; and steam smalls are firm at 9s. to 12s. 3d., according to the quality. The output is fairly good, and is well taken up—the exports being heavy. In the gas coal trade, the demand is naturally increasing. Prices are very firm—best Durhams being 13s. 9d. to 14s. per ton f.o.b. and showing some scarcity. Second-class gas coals are about 13s. 9d. to 14s. 3d. per ton; and "Wear" specials from 14s. 6d. to 14s. 9d. f.o.b. There are now a number of contracts for gas coal in the markets, including one for about 80,000 tons for Trieste, with delivery over next year. There is, however, a high freight to be added to the increased price of the coal; so that for good gas coals at Genoa the delivered price is about 7s. per ton more than a year ago—a difference in value which, of course, influences the forward sales and contracts. Coke is firm. Gas coke is higher in price; for though the production has increased, it is well taken up. Good gas coke is 23s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

There is briskness in all departments of the Scotch coal trade at present, and a scarcity of waggons hampers transit to some extent. On Friday, on the Glasgow Coal Exchange, the f.o.b. prices quoted were: Steam coal, 11s. 6d. to 12s.; splint, 13s. 6d. to 14s.; ell, 12s. 3d. to 12s. 9d.; trebles, 13s. to 13s. 6d.; doubles, 12s. 6d. to 13s.; and singles, 12s. to 12s. 6d.

Unlawful Consumption of Gas.

At the Liverpool City Police Court on Monday last week, a tradesman of Everton, named Stanfield Shelley, was charged with unlawfully connecting a gas-meter at his premises with the supply-pipe of the Liverpool United Gas Company. It was alleged that the connection was made on the 7th inst., without the defendant giving the Company notice in writing of his intention to do it. In consequence of Shelley being in arrear, the Company had sent a man to disconnect the gas supplied to the shop. After performing the operation, the man tried the jets, and found the gas was off. Notwithstanding this, however, the same night it was noticed that gas was being used; and a workman explained that it must have been turned on from the main stopcock in the street. Defendant denied all knowledge of the matter. He said all he did was to try if the gas would light at night, and he found it would do so. He said he was not really in arrear, or, at least, not more than a shilling or two. His bill was £3 7s., and he had left a deposit of £3 5s. on the meter. By taking this away, the Company had practically ruined his business. The Magistrates said they were convinced defendant knew more about the matter than he had told them; and they fined him 40s. and costs.

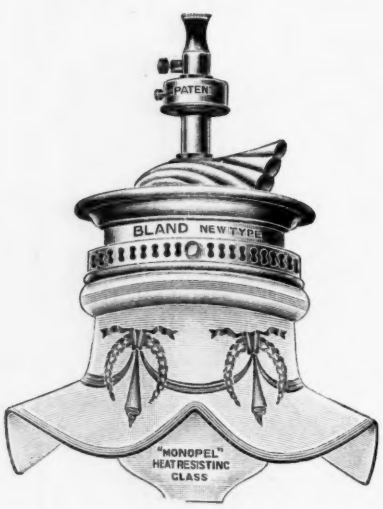
Profit-Sharing and Trade Unionism.

The subject of "Profit-Sharing and Co-Partnership" was discussed last Wednesday night by the members of the Newcastle Economic Society. The debate followed an address by Earl Grey at the inaugural proceedings of the Society a week previously. Mr. Aneurin Williams, Hon. Secretary of the Labour Co-Partnership Association, opened the discussion, and summarized at the outset what had been said by his Lordship, who tried to show that co-partnery was a practical and beneficent system. Mr. Williams went on to indicate a little more definitely what was meant by profit-sharing—viz., that a part of the net profits on a business which would otherwise go to capital should be distributed among the workers, in consideration of their services, in addition to receiving standard wages. The speaker explained how co-partnery had been built up by the South Metropolitan Gas Company, and said that about thirty gas companies had followed their example—the total amount of profit divided among the workers being £800,000. The co-partnery system of the Company named had been in existence more than twenty years. There were 5400 workers, and among them they owned £423,000 worth of the Company's stock. The system of co-partnership could be applied to every variety of business. Wherever it had been tried, the results had been admirable. It made for unity, and had brought capital and labour closer together. He did not think men should work harder; but he suggested that under co-partnery they would work more zealously and more intelligently. Apart from the harmonizing effect of the system, he thought there was no more tempting field for the extension of patriotism. In the course of his reply to the discussion, Mr. Williams said that among trade unionists opinion was divided as to co-partnery, although men like Mr. Burt, Mr. Fenwick, and Mr. John Wilson were ardent advocates of it. A large body of moderate trade unionists were either definitely in favour of co-partnery or were willing to consider it if it could be shown that it was not going to be hostile to trade unionism. Whatever form of co-partnership there was there must be trade unionism as well to maintain the essential standard wage.

Gas for Codsall and Oaken.—A long-felt want has been supplied to the residents of Codsall and Oaken by the introduction of gas, for both lighting and cooking purposes. The task to bring gas from Wolverhampton (between four and five miles away) was no easy one, to say nothing of the heavy outlay; and so the project, which has been talked of for years, has continually been shelved. At length, however, the Wolverhampton Gas Company took the matter in hand, and the work of laying down 4-inch mains was commenced as far back as last April, and was carried on through the summer months—the men employed making much overtime to ensure its completion before the bad weather set in. The Square at Codsall is now brilliantly illuminated by one tradesman; but the other places of business present a somewhat primitive appearance, through the continued use of the old-fashioned lamps.

THE

"Bland" Heat-Resisting Burners.



THE BLAND LIGHT SYNDICATE, LTD.,

LONDON AND MANCHESTER.

The "BLAND" HEAT-RESISTING BURNERS keep the Fittings quite COOL, and thus prevent them from becoming DISCOLOURED.

New Season's Catalogue now ready, Post Free.

Ilford Gas Company's Co-Partnership Scheme.

The annual general meeting of the co-partners of the Ilford Gas Company was held on the 17th inst., under the presidency of Mr. W. Ashmole, the Chairman of the Company, who was supported by Messrs. J. W. F. Mumford and C. B. Gadsdon (Directors), Mr. G. H. S. Iorns (Secretary), and Mr. W. B. Farquhar (Engineer and Manager). The Chairman said it was nearly three years since they met in order that the scheme of co-partnership which the Company had decided to adopt might be explained; and the annual bonus with which the participants were credited last June was the third. The result of the three years' working, as shown by the balance-sheet, was that the amount standing to their credit on the 30th of June last, in the investment and withdrawable bonus accounts, was £1300 12s. 11d., in addition to which £326 19s. had been expended on the purchase of the Company's stock, which was transferred to those entitled to it prior to the 30th of June. Altogether, including the bonus paid to co-partners who had left the service, the amount of bonus and interest on bonus received by co-partners to the 30th of June last was £1865 10s. 9d. Since the commencement of the scheme, owing to reductions in the price of gas, the rate of bonus had been twice increased. From 3½ per cent. it rose at Christmas, 1910, to 4 per cent., and again at Christmas last to the present rate of 4½ per cent. It was a source of much satisfaction to know that no fewer than 112 co-partners were now holders of the Company's stock; and by June next practically all would have become stockholders who had been co-partners from the first. In connection with the meeting, a smoking concert was held; and the Chairman announced that it was the intention of the Company to have a similar one every year. Mr. E. W. Roberts (of the retort-house section) thanked the Directors for the co-partnership scheme, and for providing so excellent an entertainment as that which they had so much enjoyed on this occasion.

Gas Supply in Bradford Out-Districts.—At a recent meeting of the Cleckheaton District Council, Mr. Whiteley reported upon an interview a deputation had had with the Gas Committee of the Bradford Corporation with reference to the price of gas in the hamlets of Scholes and Oakenshaw, which are in the township of Cleckheaton, but in the Bradford gas area. He set forth the arguments which had been put before the Committee—including the fact that the village of Scholes had lost several local industries on account of the high price of gas compared with that charged in the Cleckheaton area—and expressed his regret that the Bradford authorities had not seen their way to accede to the application for a reduction in price. He further intimated, however, that the Corporation were now being asked if they were willing to sell the distribution plant in the two hamlets, and on what terms; and he expressed the hope that a favourable reply might be received. The Bradford price for gas in Scholes and Oakenshaw is 6¼d. per 1000 cubic feet higher than the charge in Cleckheaton.

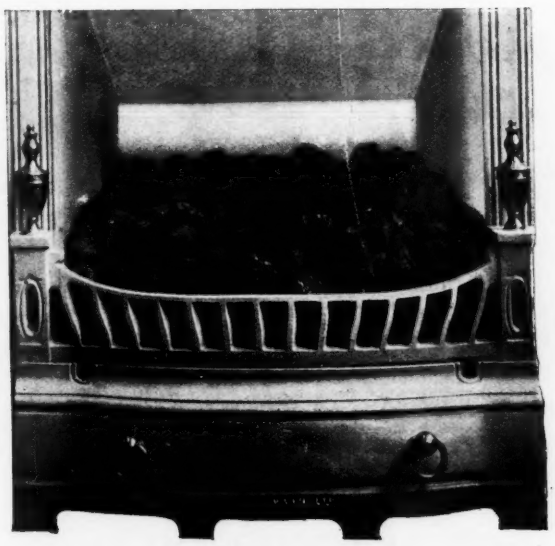
Sale of Gas and Water Stocks and Shares.

At the sale conducted by Messrs. A. & W. Richards at the Mart, Tokenhouse Yard, E.C., last Tuesday, two new issues of capital were offered by order of Directors. The first lots consisted of £3500 of "C" consolidated stock of the Aldershot Gas, Water, and District Lighting Company, carrying dividend at the maximum rate of 5 per cent.; and the issue was all placed at from par to £101 per £100. A like amount of 4 per cent. consolidated preference stock of the Company was disposed of at £90 to £93 10s. per £100. A small issue of 4 per cent. perpetual debenture stock of the Great Yarmouth Water Company realized from par to £100 10s. per £100; and £4000 of new ordinary 7 per cent. stock (carrying 4 per cent.) was sold at from £90 10s. to £91 10s. By order of executors, some £5 ordinary 7 per cent. shares in the Herne Bay Gas Company fetched £6 10s. each; and a small quantity of 5 per cent. "A" stock of the Bognor Gas Company, carrying 5⅜ per cent., was sold at £105 per £100. A parcel of new ordinary 5 per cent. "B" stock of the Southend Gas Company, carrying a dividend of 5½ per cent., realized £111 per £100. The last lots consisted of 5 per cent. ordinary stock of the South Suburban Gas Company, carrying £5 16s. 8d. per cent.; and they fetched from £119 10s. to £121 per £100. In regard to this stock, it may be mentioned that the present selling price of gas entitles the stockholders to a dividend at the rate of 6 per cent. per annum in respect of the current half year.

Birmingham Gas-Fitters' Complaints.—At the last quarterly meeting of the Birmingham Gas-Fitters' Trade Association, the Secretary reported that it had come to their knowledge that the fair-wage clause adopted by the Birmingham City Council had been violated by certain master fitters, and a communication had been issued pointing out that the new rate which came into operation in July last must be paid in accordance with the notifications already sent out. It was determined that where master fitters continued to violate the clause, the matter would be reported to the Gas Department of the Corporation—a step, it was explained, which would involve the names of such employers being struck off the list of those to whom Corporation work was given out.

Gas-Meter Testing at Salford.—The annual report of Mr. G. Hesketh, the Inspector of Gas-Meters for Salford, was presented at a meeting of the Borough Justices last Thursday and approved. Attention was called specially to an explanation contained in the report regarding the testing of prepayment meters, which the Justices hoped would have the effect of removing any misconception which might exist in the minds of the public that poor people suffered when the prepayment apparatus happened to be out of order. The amount of gas actually consumed, Mr. Hesketh pointed out, was registered by the gas-meter proper, and recorded by the index in exactly the same manner as by an ordinary meter. If, however, by any mischance the prepayment arrangement was out of order, it would soon be made manifest by the reading of the index.

APPRECIATION.



ANOTHER UNSOLICITED TESTIMONIAL!

HOLLAND STREET, KENSINGTON.

"I must send you a few lines expressing my very cordial thanks and appreciation. . . . THE MARK II. ST. NICHOLAS IS NOW IN AND IT IS THE MOST ABSOLUTELY PERFECT GAS FIRE THAT COULD POSSIBLY BE INVENTED. . . . I AM SO DELIGHTED WITH MY NEW FIRE THAT I LIGHT IT FOR THE MERE PLEASURE OF LOOKING AT ITS BRIGHT CHEERFUL FACE. . . . I do not believe there is another firm in London who would have met the difficulty. . . . All my friends agree with me in this, and I intend to ask for a supply of booklets of yours to send round to everybody likely to use a gas fire. I CONSIDER IT AN ACT OF KINDNESS TO MY FRIENDS TO INTRODUCE THE MARK II. ST. NICHOLAS.

"IT IS MORE THAN YOU CLAIM FOR IT."

(The original letter is in our possession.)

THE "ST. NICHOLAS" FIRE.

R. & A. MAIN, LIMITED,

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 13, Whitworth Street West, MANCHESTER; 8, Exchange Place, Donegall Street, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

Colonial Gas Association, Limited.—In the report which the Directors will present at the annual general meeting of the Association next Tuesday, they state that, after allowing for depreciation, there remains a profit of £7244, to which has to be added the amount brought forward; making an available balance of £8639. It is proposed to pay a final dividend of 4 per cent., free of tax; making 6 per cent. for the year (the same as last year), and to carry forward £1408. Further reductions have been made in the price of gas. The number of additional customers was greater last year than in any previous similar period; while the sales of gas show an average increase of 16¾ per cent. for the year. Negotiations are in progress for the purchase of two additional gas-works, which the Directors are of opinion will be of advantage to the Association.

Withernsea Water Supply.—The Withernsea Urban District Council last Tuesday considered a report from Messrs. Wallin and Taylor, of Newcastle-on-Tyne, with reference to the water supply of the district. It was stated that a preliminary survey had now been made; particular attention being paid to land at Winestead, the warp lands of Hollym Carr, and the gravel-beds at Keyingham and Burstwick. The water hitherto obtained was quite unusable, owing to the large amount of salt, magnesia, and lime it contained. Present needs could be met by a supply of 100,000 gallons per day. The engineers recommended that trial holes should be sunk and further investigations made. They estimated that the Hollym Carr scheme would cost £11,000 or £12,000, apart from the land, and the annual working expense would be from £900 to £950. The cost of the Burstwick gravel-beds scheme would be £14,000 or £15,000, and the annual working expense £1100. They said these figures were approximate, as the prices of materials had advanced 15 per cent. during the last twelve months, owing to the Insurance Act and other causes. It was resolved to carry out trial bores at Burstwick and Hollym Carr, at a cost not exceeding £50.

Charge of Murder by Coal-Gas Poisoning.—Just before midnight on the night of Saturday, the 19th inst., Mrs. Florence Stezaker, wife of a weaver named James Stezaker, residing in Burnley, and their child Mary, aged three years, were found dead in their bedroom, having been poisoned by coal gas. There were marks on the woman's throat showing that an attempt had been made at strangulation; and her husband was lying on the floor unconscious from partial strangulation. He had a scarf tied tightly round his throat, and was also suffering from gas poisoning. He revived as the result of artificial respiration, and was removed to the police station, where he was charged with double murder and attempted suicide. Stezaker is 22 years of age, and his wife 32. They had, it appears, lived on excellent terms; but it was stated that the man had latterly been unwell and depressed because he failed to find regular work outside a cotton-mill. Investigations by the police showed that the gas-bracket had been unscrewed from the wall, and consequently there was a large escape of gas into the room. At the inquest, medical evidence was given to the effect that death was due to asphyxiation and strangulation; and a verdict of "Wilful murder" was returned against the accused man.

Thorne and District Water Supply.—The Thorne and District Water Company, which, as already announced, has just been formed to ensure a good supply of water for the district, intend at the outset, acting on the advice of their Engineers (Messrs. Fairbank and Son, of York) to confine operations to the supply of water to Thorne and Hatfield from the borehole at the latter place.

Failure of Gas Supply at Beeston.—In connection with a street improvement scheme now in progress at Dunkirk, a suburb of Nottingham, a disturbance of mains was necessary; and last Thursday afternoon was chosen for carrying out the work, as being likely to cause the least inconvenience to the tradespeople. It appears that the gas was sent into a 4-inch pipe, instead of the usual 12-inch one, with the result that Beeston was practically deprived of its supply and plunged in semi-darkness. Work had to be suspended at Beeston Foundry; while much inconvenience was experienced at the Station Hotel. At the latter place, the light was restored about nine o'clock.

Peat for Coke Manufacture.—Much interest has been aroused in South Yorkshire by a proposal to use the peat from the extensive moors around Thorne and Doncaster in the manufacture of coke of such a hardness and character as to make it invaluable in steel smelting. Experiments with peat have been made for years, but with little success. Now Mr. J. W. Leadbeater, of Doncaster, claims to have solved the problem by not only producing from peat coke of a hardness hitherto unknown, but at the same time containing a very small proportion of sulphur. It is claimed that the manufacture of this peat coke can be conducted on a paying commercial basis, and that many valuable bye-products will be yielded.

Less Light for More Money.—Under this heading, a correspondent writes as follows to the "Hastings and St. Leonards Observer:" "To those of us who do not like to see waste going on, it has been a matter of regret this week to see the Corporation workmen dismantling the double-burner gas-lamps in Queen's Road, and consigning them to the scrap heap in the storeyard. These lamps were in good condition, and would have lasted many more years, when perhaps a more satisfactory electric lamp might have been on the market, as one hears on every hand how insignificant the electric lamps look which the Corporation are putting up; while the light is yellow and poor compared with the incandescent gas which it replaces."

Price of Gas and Electricity in Bradford.—Speaking at a meeting in support of a candidate for the next municipal elections in Bradford, Alderman G. H. Robinson said the time had arrived when the Corporation could produce gas at a price that made it possible to use it for domestic purposes almost as cheaply as coal. It was only a question of educating the people. It had been said that electricity was too expensive for the working man. In Bradford, a working-class family paid from 4d. to 6d. a week for gas. As a matter of fact, the Bradford Electricity Committee could give daily four hours' lighting of 40-candle power for 6d. a week. He claimed, therefore, that electricity was now a commodity within the reach of the working people of Bradford.

ABSOLUTE FREEDOM FROM CORROSION.

No rubber or perishable material is used in the manufacture of

PARKINSON GAS-HEATED STEAM RADIATORS.

Practical designs, combined with expert workmanship and high-class materials, ensure

HIGHEST HEATING EFFICIENCY

AND

ENTIRE SATISFACTION.

The Parkinson Stove Co., Ltd.,

BIRMINGHAM & LONDON.

Steam-Rollers and Gas and Water Mains.—The question of the liability of highway authorities for damage done to mains by the rolling of road surfaces was referred to at a meeting of the Cornwall Highway Committee last Friday. The Surveyor stated that he had received a letter from the Truro Water Company complaining of alleged damage to mains through the use of a steam-roller. The same question, he added, had been raised in various parts of the county, especially where gas and water mains were laid with insufficient cover. He had always repudiated liability; maintaining that the act of repairing, altering, or improving the surface of the roads, including consolidating by means of a steam-roller, was not interference with the mains; that the statutory powers possessed by gas and water companies did not take away or abridge any of the powers vested in the highway authority; and that the authority could not be held liable for any expenses in addition to those which they would necessarily have incurred in reconstructing, repairing, or improving the road if the main had not been laid under it. He thought it very desirable that a definite opinion should be obtained on this question. The Clerk remarked that if the companies laid their pipes so near the surface of the roads that they were likely to be damaged, it was entirely their affair.

According to a paragraph in the "Leeds Mercury," the substitution of high-pressure gas for electric lighting in the Corporation Markets was attended by rather unexpected results a few mornings since. The following were the circumstances: "In the dark hours of early morning, the new lights were suddenly switched on. The effect was so startling that all the roosters in the poultry department awoke with a start; and, apparently imagining that the sun had risen unbidden and unexpectedly, began crowing with all their might. Startled by the noise and by the unusual glare of the light, several police officers hurried to the market gates, only to find the Gas Department workmen laughing at them for their unnecessary alarm."

We have received from Messrs. Falk, Stadelmann, and Co., of Farringdon Road, a copy of their supplementary gas-fittings catalogue No. 346, and their fancy bead shade list, which have just been issued. The former shows a range of cheap brackets, which have been introduced to counteract, as far as the metal market and compatibility with strength and efficiency will allow, the serious advance in price of these goods. There is a full choice of bead-shade pendants and hall lights, and other fittings, including heavy shop and school pendants. The "Stellux" high-power low-pressure lamp is provided with a new gas atomizer with china insulation and a new air-regulator, which are claimed to ensure a perfect mixture and the greatest light development obtainable without auxiliary plant. A big demand is being experienced for the well-known "Ukay" lamp, which is fully illustrated. The list of fancy beaded curtains for use with inverted burners is printed in colours, thus giving a very effective representation of the articles referred to.

"High-Pressure Gas" is the subject of the leading article in the "Bedford Daily Circular" for Thursday last. The writer describes the compressing process, and then gives the following comparison of gas and electricity based on the prices current at Bedford: Gas at 2s. 6d. per 1000 cubic feet, supplied at the new high-pressure of 60 inches (instead of the familiar 2 or 3 inches as supplied from gas-works), burns per hour, with inverted mantles, 166 cubic feet, yielding 10,000-candle power, and costing 5d. Thus 1000-candle power costs ½d. per hour, or each 10-candle lamp 1-200th of a penny. The compressor costs from £3 to £13. Electricity at 5d. per unit to produce the same candle power consumes per hour, with an Osram bulb, 12·5 units, costing 5s. 2d.; with a new low-voltage bulb, 10 units, costing 4s. 2d.; and with an arc lamp, 3·7 units, costing 1s. 6d. With regard to maintenance, a bulb costs 2s. 6d., and lasts, unless a filament breaks, 1000 to 3000 hours—say, from 16 to 52 weeks of 60 hours. Some makers contract for 2000 hours.

Speaking last Thursday at a meeting in the interest of the Liberal candidates for two of the wards in Sheffield at the approaching municipal elections, Sir William Clegg referred to the electricity undertaking of the Corporation. He said that when the undertaking was municipalized, the Electric Light Company carried on an extensive wiring and fittings and factory department, outside as well as inside Sheffield. For the year ended Dec. 31, 1897, they received, in respect of the department, £20,483, of which £1595 represented net profit. The amount of capital expended by the Company on the department was £6054. The Corporation had to pay £213 for every £100 of expenditure incurred by the Company since its formation. Therefore they had to pay a premium on this £6054 of £7292; making the total paid in cash for this branch of the undertaking £13,344. Since then the Corporation had put in capital amounting to £2670, and £5228 for motors which they bought for hire; bringing up the cost of the wirings and fittings and factory department to a sum which stood in the books of the Corporation at £21,242.

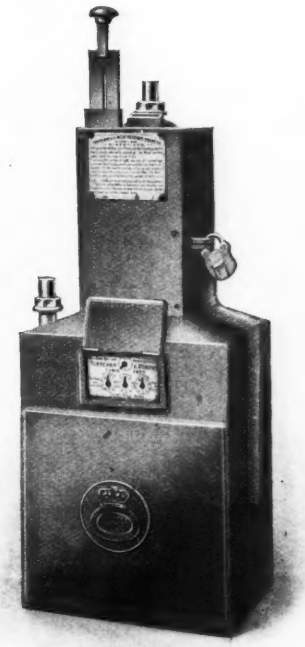
A batch of sample advertisements of the excellence usual with their author in point of topical and seasonal propriety, has been received from Mr. T. E. Pye, of Chichester. The advertisements have appeared in the local Press for the Chichester Gas Company. We will refer to only two of them to show their character. One is headed "Not to-day, thank you!" And that is the answer (in what succeeds) that is given by the user of gas-stoves to those disturbers of the domestic peace and routine the sweep, the dustman, the coal vendor, and others, including the national insurance stamp card inspector, who is informed that "We now have no servants." In another advertisement music lovers will have their attention arrested by the first few bars of music of "In the Shadows." This song, the advertisement tells us, "has had its day—a long and creditable one. But 'In the Light' of the 'Regent' show window lamp, night is turned into day—a long and profitable one!" It is in the display of the advertisements, as well as in the actual wording, that the art of the good advertisement designer is found; and Mr. Pye shows a strong possession of the very useful faculty of catching the eye of the newspaper reader.

ALWAYS FIRST

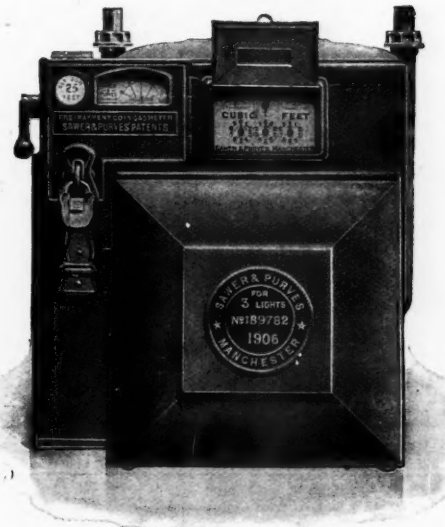
THE

"POSITIVE"

PREPAYMENT METER.



FIRST OVER 20 YEARS AGO.



FOREMOST TO-DAY.

SAWER & PURVES,

(BRANCH OF METERS LIMITED)

MANCHESTER & NOTTINGHAM.

Agent for Scotland: J. D. GIBSON, 2, CAUSEYSIDE ST., PAISLEY.

The Gas Committee of the Birkenhead Corporation have placed with Messrs. George Waller and Son an order for the supply of compressing plant, forming part of the gas-works extension scheme; the cost of the installation being £1742.

In addition to the visit to the East Greenwich Gas-Works of the South Metropolitan Company, noticed elsewhere, the members of the Association Générale des Hygiénistes et des Techniciens Municipaux, while in London last week, were enabled to inspect the pumping machinery and the reservoirs of the Metropolitan Water Board at Hampton, under the guidance of Mr. W. B. Bryan, M.Inst.C.E.

Authority has been given by the Sandown (I.W.) Urban District Council for the employment by the Water Committee of an expert to report upon the value of the Isle of Wight Water-Works, which have been offered them by Lord Alverstone, at the price of £45,000. The arrangement is to be on a 25 years' purchase of the profits, returned annually as being £1803. The negotiations were commenced by Lord Alverstone so far back as 1903, and the Council favour settlement by agreement, rather than by arbitration. The assumption is that, by the growth of residents in the district, the purchase will before long afford considerable relief to the rates.

GAS COMPANIES' STOCK AND SHARE LIST.

The condition of markets in general on the Stock Exchange did not improve last week. The settlement of the current nineteen-day account was an ugly bogey ahead, having regard to the panicky rush to sell which all Foreign bourses were exhibiting the week before last. The inevitable concomitant was a considerable amount of realizing here at home. Government stocks have sat tight. Home Rails and Americans have receded, however, while in the Foreign Market none but the issues of the successful belligerents did well. On Monday, after a mild opening, the tone was adversely affected by renewed pressure from Paris to sell; but this chiefly hit those speculative lines most beloved on the Bourse. The rest were only moderately sympathetic; while Consols actually rose. But Tuesday was much weaker, under strong pressure of a similar nature. Everything went down; sound stable stuff as well as popular speculative counters. Certainly the rot was stopped before the end of the day; but all closed in a damaged condition. Wednesday opened with some show of cheerfulness; but weakness supervened, prompted more by doubts and fears than ascertained facts. All markets were lower. Business was very quiet on Thursday; and the tone was dull, though in a lesser degree. Prices in general were easier, and Consols fell ⅛. On Friday, the tendency was not uniformly bad. Gilt-edged things improved, and Consols recovered their lost ⅛. In Rails, some went up and some went down; but Americans were all flat on persistent selling across the Atlantic. Not much was doing on Saturday; but there was some disposition to look hopefully at things, and markets were fairly steady. Consols were ⅛ better for the account, and closed at 73 to 73¼ for money—the same as a week previously. In the Money Market, there was marked firmness upon a good demand, and discount rates grew steadily harder. Business in the Gas Market made up a fair average volume in the aggregate, but was so restricted in its scope that the number of undertakings dealt in again failed to exceed a dozen. The general tendency was quite satisfactory, having regard to the circumstances of the times. In Gaslight and Coke issues, the ordinary was moderately active and marked 103½; but later on, amid the prevailing depression, it touched 103⅜. Partially recovering near the close, the quotation showed only a ⅛ point reduction. In the secured issues, the maximum was done at 81½ to 83, the preference at 100 and 101, and the debenture at 77 to 78. South Metropolitan was firm and unchanged at 116¼ to 117½; and the debenture marked 78 and 78½. Commercials were again untouched; there being no stock in the market. Among the Suburban and Provincial group, Brighton and Hove original realized 210½, and British 44¾. On the local Exchanges, Liverpool "B" was done at 157, Newcastle at 99 (a rise of ½), Sheffield "A" at 231 (a rise of 1), ditto "B" at 230, and Tynemouth at 115—a rise of ¼. In the Continental companies, Imperial changed hands at 181 to 183¾, ditto debenture at 87½, Union at 80 (a fall of 2), and European at 19¼ and 19½. Among the undertakings of the remoter world, Monte Video made 11⅜ and 11⅝, Oriental 135½, Primitiva from 6⅜ to 6⅞, ditto preference from 5⅜ to 5⅝, River Plate debenture 93, and San Paulo preference 11½ and 11⅝.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 11	5	Alliance & Dublin Ord.	76–81*	..	6 3 5
374,000	Stk.	July 12	4	Do. 4 p.c. Deb.	89–91	..	4 7 11
250,000	5	Oct. 11	7½	Bombay, Ltd.	6⅜–6⅝*	..	5 9 1
50,000	10	Aug. 29	15	Bourne- mouth Gas & Water } 10 p.c. B 7 p.c. Pref. 6 p.c.	25–29	..	5 3 5
332,000	10	,,	7		15½–16½	..	4 6 2
75,000	10	,,	6		14–14½	..	4 2 9
380,000	Stk.	Aug. 14	13½	Brentford Consolidated	257–262	+2	5 3 1
330,000	,,	,,	10½	Do. New	197–202	+2	5 4 0
50,300	,,	,,	5	Do. 5 p.c. Pref.	116–118	..	4 4 9
206,250	,,	June 14	4	Do. 4 p.c. Deb.	96–98	..	4 1 8
218,230	Stk.	Aug. 29	11	Brighton & Hove Orig.	210–215	..	5 2 4
244,300	,,	,,	8	Do. A Ord. Stk.	152–155	..	5 3 3
530,000	20	Sept. 27	12½	British	44–45	..	5 11 1
120,000	Stk.	June 28	4	Do. 4 p.c. Deb. Stk.	91–93	..	4 6 0
245,771	Stk.	June 28	4	Buenos Ayres 4 p.c. Deb.	93–95	..	4 4 3
100,000	10	—	—	Cape Town & Dis., Ltd.	2–3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	3½–4½	..	—
100,900	Stk.	June 28	4½	Do. 4½ p.c. Deb. Stk.	70–73	..	6 3 3
157,150	Stk.	Aug. 29	5	Chester 5 p.c. Ord.	107½–109½	..	4 11 4
1,513,280	Stk.	Aug. 29	5/9/4	Commercial 4 p.c. Stk.	106–108	..	5 1 2
560,000	,,	,,	5½	Do. 3½ p.c. do.	101–103	..	5 3 6
475,000	,,	June 14	3	Do. 3 p.c. Deb. Stk.	73–75	..	4 0 0
800,000	Stk.	May 31	4	Continental Union, Ltd.	80–83	−2	4 16 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	133–135	..	5 3 8
492,370	Stk.	—	5¾	Derby Con. Stk.	124–125	..	4 12 0
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
1,002,180	10	July 26	10	European, Ltd.	19–20	..	5 0 0
16,160,600	Stk.	Aug. 14	4/17/4	Gas- light & Coke } 4 p.c. Ord.	101½–103½	−½	4 14 1
2,600,000	,,	,,	3½	3½ p.c. max.	81–84	..	4 3 4
4,062,235	,,	,,	4	4 p.c. Con. Pref.	93½–101½	..	3 18 10
4,631,705	,,	June 14	3	3 p.c. Con. Deb.	76–78	..	3 16 11
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	91–93	..	5 7 6
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 11	11	Hongkong & China, Ltd.	16–16½*	..	6 13 4
131,000	Stk.	Sept. 13	7⅞	Ilford A and C	154–157	..	4 17 1
65,780	,,	,,	6⅛	Do. B	121–123	..	4 19 7
65,500	,,	June 28	4	Do. 4 p.c. Deb.	91–93	..	4 6 0
4,940,060	Stk.	May 15	9	Imperial Continental	180–185	..	4 17 3
1,235,000	Stk.	Aug. 14	3½	Do. 3½ p.c. Deb. Red.	86–88	..	3 19 7
200,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.	122–125	..	4 16 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A.	216–218	+1	4 11 9
718,100	,,	,,	7	Do. B.	155½–157½	..	4 8 11
306,083	,,	June 28	4	Do. Deb. Stk.	100–102	..	3 18 5
63,480	Stk.	June 28	3	Maidstone 3 p.c. Deb...	69–71	..	4 4 6
75,000	5	June 14	6	Malta & Mediterranean	4⅜–4¾	..	6 3 1
250,000	100	Oct. 1	4½	Met. of Melbourne } 4½ p.c. Deb.	99–101	..	4 9 1
541,920	20	May 31	3½	Monte Video, Ltd.	11¼–11⅜	+⅛	5 19 2
1,775,892	Stk.	July 26	4⅜	Newc'tle&G'tesh'd Con.	98½–99½	+½	4 8 2
529,705	Stk.	June 28	3½	Do. 3½ p.c. Deb.	85–86	+⅛	4 1 5
55,940	10	Aug. 29	7/7/0	North Middlesex 7 p.c.	13½–14½	..	5 1 5
300,000	Stk.	May 15	8	Oriental, Ltd.	134–136	..	5 17 8
60,000	5	Sept. 27	10	Ottoman, Ltd.	5¼–5⅜	..	5 14 3
60,000	50	Aug. 14	13	Portsea Island B	127–130	..	5 0 0
100,000	50	,,	12	Do. C	124–127	..	4 14 6
249,980	5	Oct. 11	8	Primitiva Ord.	6⅜–7*	..	5 14 4
499,960	5	June 28	5	Do. 5 p.c. Pref.	5–5¼	..	4 15 3
521,600	100	June 1	4	Do. 4 p.c. Deb.	96–98	..	4 1 8
346,198	Stk.	June 28	4	River Plate 4 p.c. Deb.	93–95	..	4 4 3
275,000	5	Apl. 12	12	San Paulo, Ltd.	13–14	..	4 5 9
150,000	10	Sept. 27	6	Do. 6 p.c. Pref.	11½–12	..	5 0 0
125,000	50	July 1	5	Do. 5 p.c. Deb.	49–51	..	4 18 0
135,000	Stk.	Aug. 29	10	Sheffield A	230–232	+1	4 6 2
209,984	,,	,,	10	Do. B	229–231	..	4 6 7
523,500	,,	,,	10	Do. C	229–231	..	4 6 7
90,000	10	Sept. 27	7½	South African	9–10	..	7 10 0
6,429,895	Stk.	Aug. 29	5/9/4	South Met., 4 p.c. Ord.	116–118	..	4 12 8
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	76–79	..	3 15 11
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.	162–164	..	5 3 8
605,000	Stk.	Aug. 14	5/16/8	S'th Suburb'n Ord. 5 p.c.	119–121	..	4 16 3
60,000	,,	,,	5	Do. 5 p.c. Pref.	117–119	−1	4 4 0
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120–122	..	4 2 0
594,740	Stk.	May 15	5	Southampton Ord.	105–107	..	4 13 6
120,000	Stk.	Aug. 14	7½	Tottenham and Edmonton } A 5 p.c. B 3½ p.c.	142–145	..	5 0 0
483,940	,,	,,	5¾		114–116	..	4 19 2
149,470	,,	June 28	4	4 p.c. Deb.	94–96	..	4 3 4
182,380	10	June 15	5	Tuscan, Ltd.	8⅛–8⅝	..	5 15 11
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	97–99	..	5 1 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	115–115½	+½	4 6 7
255,636	Stk.	Aug. 29	6⅞	Wands- worth } B 3½ p.c. 3 p.c. Deb. Stk.	133–141	..	4 17 6
85,766	,,	June 28	3		70–72	..	4 3 4

Prices Marked * are "Ex. Div."

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

MANAGER. Lisburn Urban District Council. Application by Nov. 9.
MANAGER. Irvine Gas Company. Applications by Nov. 4.
EXPERT IN GAS-FIRE CONSTRUCTION. No. 5640.
CHEMIST. No. 5645.
DRAUGHTSMAN. R. & J. Dempster, Limited, Manchester.
WORKING MANAGER. No. 5642.
WORKING FOREMAN. Brymbo Water Company.
GAS FITTER. Rugby Gas Company.
GAS FITTERS. Birmingham Gas Department.
SERVICE LAYER. Rugby Gas Company.
DISTRICT CANVASSER. Reading Gas Company.

Partner Wanted.

Box 602. Coop's, Copthall Court, E.C

Plant, &c. (Second-Hand), for Sale.

LAMP COLUMNS AND LANTERNS. Barnsley Gas Company.

Licensees Wanted.

"ST. MUNGO" GAS-FIRE, Mr. P. Fyfe, 23, Montrose Street, Glasgow.

Patent Licences, &c.

HASELTINE, LAKE, AND CO., 7 and 8, Southampton Buildings, W.C.
MANUFACTURE OF GAS FROM LIQUID HYDROCARBONS.

Stocks and Shares.

BOGNOR GASLIGHT AND COKE COMPANY. By Auction. London Mart. Nov. 12.
GRAVESEND AND MILTON GAS COMPANY. By Auction. London Mart. Nov. 12.
GRAYS AND TILBURY GAS COMPANY. By Auction. London Mart. Nov. 5.
SOUTH ESSEX WATER COMPANY. By Auction. London Mart. Nov. 5.
TENDRING HUNDRED WATER COMPANY. By Auction. London Mart, Nov. 5.

TENDERS FOR Fire-Clay Goods.

SHEFFIELD GAS COMPANY. Tenders by Nov. 5.